The Egyptian Journal of Hospital Medicine (January 2018) Vol. 70 (12), Page 2042-2049

Parasitic Profile among Primary School Children in A Rural Area at Beheira Governorate, Egypt

Ahmed M. S. Bayoumy[1], Mohamed A. Abd El Raheem[2], Anwar H. Abo Hashim[1], Ahmed S. K. Al Saadawy[2], Islam M. R. Al Karyony[2]

1. Department of Medical Parasitology, Faculty of Medicine, Al-Azhar University, Cairo, Egypt.
2. Department of Medical Parasitology, Faculty of Medicine Al-Azhar University, Assiut, Egypt.

Corresponding author: Ahmed Bayoumy, email: drahmedbayoumy@azhar.edu.eg

ABSTRACT

Background: Parasitic infection is still a serious public health problem in the world, especially in developing countries including Egypt. It represents a major cause of morbidity and mortality in childhood and among high-risk groups in most parts of the world. **Objectives:** This study aimed to detect the prevalence of parasitic infection and degree of anemia and eosinophilia among primary school children of two governmental schools in a rural area at Damanhour Center, Beheira Governorate, Egypt during the period from October, 2016 to April, 2017.

Methods: Randomly chosen (600) students aged from (6 – 12) years, (394 males and 206 females were subjected to: A questionnaire sheet, stool examination using: Direct smear and concentration techniques (formol ether sedimentation and simple flotation), urine examination, NIH swab for diagnosis of *E. vermicularis* eggs as well as complete blood count examination.

Results: The overall prevalence of parasitic infection reached 38.3% (27.8% in males and 10.5% in females) with a prevalence rate of (22.5%), (12.8%) and (3%) for helminthic, ptotozoal and mixed infections respectively. The identified parasites were *E. vermicularis* (11.8%), *H. nana* (7.2%), *G. lamblia* (6.8%), *E. histolytica*/*dispar* (6%), *S. mansoni* (1.7%), *A. lumbricoides* (1.2%), *T. trichiura* (0.3 %) and *S. haematobium* (0.3 %) while, mixed infection reached (3%). The eggs of *E. vermicularis* were found in both urine and stool specimens of three girls only. Prevalence of anemia among all studied children reached (41.8%); (67.8%) in infected children compared to (25.7%) in non-infected children while eosinophilia was (6%); (14.3%) in infected children compared to (0.8%) in non-infected children with statistically significant difference. There was a significant correlation between parasitic infection and headache, fatigue, pallor, loss of appetite, abdominal colic, perianal itching, diarrhea, pitryasis alba, loss of weight and salivation during sleeping. Also, there was a significant association between parasitic infection and some bad hygienic habits as un-proper hand washing and hygiene, swimming in canals, un-trimming of finger nails and un-proper washing of vegetables and fruits.

Conclusion: Rural residency, bad hygiene and low social class were the most significant risk factors associated with parasitic infections**.**

Keywords: Egypt, Beheira Governorate, Primary school children, Intestinal parasites, Rural community.

INTRODUCTION

Parasitic infections are a major public health problem worldwide particularly in the developing countries and constituting the greatest cause of illness and disease [(1)]**.** However, the prevalence of intestinal parasitic infections (IPI's) varies considerably from place to another in relation to the pattern of transmission of the disease [(2)]**.** In Egypt, enteric parasitic infections still the cause of major health problems among Egyptian children as they have great morbid effect on their physical and cognitive development and increased susceptibility to other infections [(3)]**.** From health perspective, IPI's affect the physical and mental wellbeing of school children thereby leading to increased absenteeism, retarded cognitive development and thus learning disabilities [(4)]**.** In spite of the increased public health importance of parasitic infections, but it was focused mainly on chemotherapy as a means of control while the study of social, cultural and economic factors underlying infection risk has been relatively neglected [(5)]**.**

The present study aimed to evaluate the prevalence of parasitic infection and association between it and different types and degrees of anemia and eosinophilia among primary school children in a rural area at Damanhour Center, Beheira Governorate, Egypt.

MATERIALS AND METHODS

The present study was carried out in Beheira Governorate which is located at the Western part of the Delta region, Egypt and conducted on (600) primary school children aged between (6-12) years old of Al Mansheia; Al Ebrahemia and Abo Tabl primary schools which were located in a rural area at Damanhour Center, during the period from October,

Received: 20/12/2017 DOI: 10.12816/0045027
Accepted: 30/12/2017

2016 to April, 2017. The exclusion criteria were children above 12 years or below 6 years, those with a history of an underlying illness or blood diseases, children who had taken anti-helminthic drugs within few weeks of the study and/or those who received a blood transfusion or iron containing medications within few weeks preceding the study. All children were subjected to the following: **(1)** a questionnaire filled out by an interview with the child and/or one of his/her parents. **(2)** Fresh stool and urine samples were collected in clean, labeled and wide mouthed plastic containers that had tight fitting overlapping lids. **(3)** National Institute of Health (NIH) swab for diagnosis of *Enterobius vermicularis* (done for children suffering from perianal itching) [(6)]**. (4)** Collection of aseptically venous blood samples for complete blood count (CBC) examination using **Mindray BC-5800** auto hematology analyzer.

Stool samples were examined macroscopically and microscopically by: **(i)** direct wet smear method [(7)]**. (ii)** Concentration methods by simple floatation and formol ether sedimentation techniques [(8)]**.** Urine examination was done through sedimentation method [(7)]. **The study was approved by the Ethics Board of Al-Azhar University.**

RESULTS

A total of 230/600 (38.3%) children were parasitically infected **Fig. (1)**. The prevalence rate of infection reached (22.5%), (12.8%) and (3%) for helminthic, protozoal and mixed infection respectively. The identified parasites were: *E. vermicularis* (11.8%), *H. nana* (7.2%), *G. lamblia* (6.8%), *E. histolytica*/*dispar* (6%), *S. mansoni* (1.7%), *A. lumbricoides* (1.2%) while *T. trichiura* and *S. haematobium* had the same percentage of (0.3%) **Table (1) and Fig. (2)** and mixed infection reached (3%) **Table (2) and Fig. (3)**. The eggs of *E. vermicularis* were found in both urine and stool specimens of three girls only**.** Regarding anemia, a total of 251/600 (41.8%) children had anemia, out of 230 infected children 156 (67.8%) had anaemia while, out of 370 non- infected children 95 (25.7%) had anemia, **Table (3) and Fig. (4).** Regarding eosinophilia, a total 36/600 (6%) children had eosinophilia, out of 230 infected children 33(14.3%) children had eosinophilia while, out of 370 non-infected children 3 (0.8%) had eosinophilia, **Table (4) and Fig. (5).**

Table (1): Distribution of parasitic infections among studied school children

Parasite		No. of infected children	%	Males	%	Females	%
vermicularis	Stool & Urine Examination	8	11.8	5	8	3	3.8
	NIH swab	71		48		23	
. nana		43	7.2	33	5.5	10	1.7
. lamblia	Cyst	41	6.8	34	5.7	7	1.2
histolytica/dispar	Cyst	31	6	20	3.8	11	2.2
	Trophozoite	5		3		2	
S. mansoni		10	1.7	10	1.7	0	
A. lumbricoides		7	1.2	4	0.7	3	0.5
S. haematobium	Urine Examination	2	0.3	2	0.3	0	0
T. trichiura		2	0.3	2	0.3	0	0
Mixed infection		18	3	11	1.8	7	1.2
Total prevalence		**230**	**38**	**167**	**28**	**63**	**11**

Table (2): Distribution of mixed parasitic infections among infected school children

Mixed infection	Infected Children No. (%)	Males No. (%)	Females No. (%)
E. histolytica* + *G. lamblia	7 (3%)	5 (2.2%)	2 (0.9)
E. vermicularis* + *E. histolytica/dispar	5 (2.2%)	2 (0.9%)	3 (1.3%)
S. mansoni* + *E. histolytica/dispar	2 (0.9%)	2 (0.9%)	0 (0%)
A. lumbricoides* + *E. histolytica/dispar	2 (0.9%)	1(0.4%)	1(0.4%)
S. mansoni* + *H. nana	1(0.4%)	1(0.4%)	0 (0%)

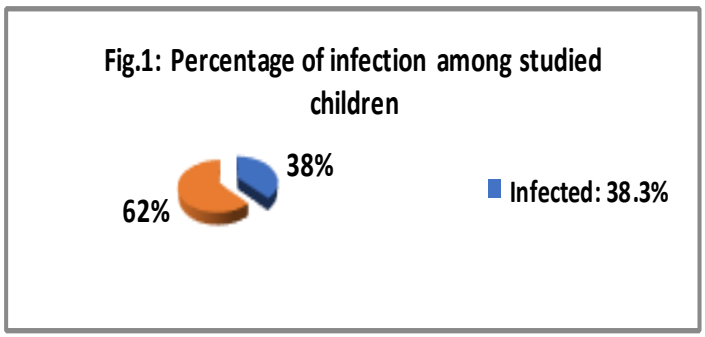
A. lumbricoides + E. vermicularis	1(0.4%)	0 (0%)	1(0.4%)
Total No.	**18 (7.8%)**	**11(4.8%)**	**7 (3%)**

Table (3): Distribution of types and severity of anemia among infected school children

Parasites	Number	Normocytic Normochromic Anemia (No. = 109)			Microcytic Hypochromic Anemia (No. = 47)		
		Mild No (%)	Moderate No (%)	Severe No (%)	Mild No (%)	Moderate No (%)	Severe No (%)
E. vermicularis	35	21 (60)	6 (17.1%)	0 (0%)	6 (17.1%)	2 (5.7%)	0 (0%)
H. nana	35	19 (54.3%)	11 (31.4%)	0 (0%)	4 (11.4%)	1 (2.9%)	0 (0%)
G. lamblia	29	9 (31%)	3 (10.3%)	0 (0%)	15 (51.7%)	2 (6.9%)	0 (0%)
E. histolytica/dispar	25	12 (48%)	5 (20%)	0 (0%)	5 (20%)	3 (12%)	0 (0%)
S. mansoni	8	0 (0%)	6 (75%)	0 (0%)	0 (0%)	2 (25%)	0 (0%)
A.lumbricoides	4	2 (50%)	1 (25%)	0 (0%)	1(25%)	0 (0%)	0 (0%)
T. trichiura	2	0 (0%)	1 (50%)	0 (0%)	0 (0%)	1 (50%)	0 (0%)
S. haematobium	2	0 (0%)	1 (50%)	0 (0%)	0 (0%)	1 (50%)	0 (0%)
Mixed infection	16	3 (18.75%)	9 (56.25%)	0 (0%)	1(6.25%)	3 (18.75%)	0 (0%)
Total Number (%)	**156 -67.80%**	**66 -42.30%**	**43 -27.60%**	**0 0%**	**32 -20.50%**	**15 -9.60%**	**0 0%**

Table (4): Distribution of eosinophilia among infected school children

Parasites	Positive cases	Eosinophillia			Total
		Mild No. (%)	Moderate No. (%)	Severe No. (%)	
E. vermicularis	71	2 (2.8%)	0 (0%)	0 (0%)	2 (2.8%)
H. nana	43	2 (4.7%)	1(2.3%)	0 (0%)	3 (7%)
G. lamblia	41	2 (4.9%)	0 (0%)	0 (0%)	2 (4.9%)
E. histolytica/dispar	36	2 (5.6%)	0 (0%)	0 (0%)	2 (5.6%)
S. mansoni	10	9 (90%)	1(10%)	0 (0%)	10 (100%)
A. lumbricoides	7	2 (28.6%)	0 (0%)	0 (0%)	2 (28.6%)
S. haematobium	2	2 (100%)	0 (0%)	0 (0%)	2 (100%)
T. trichiura	2	1 (50%)	0 (0%)	0 (0%)	1 (50%)
Mixed infection	18	7 (38.9%)	2 (11.1%)	0 (0%)	9 (50%)
Total Number (%)	230	29 (12.9%)	4 (1.8%)	0 (0%)	33 (14.3%)



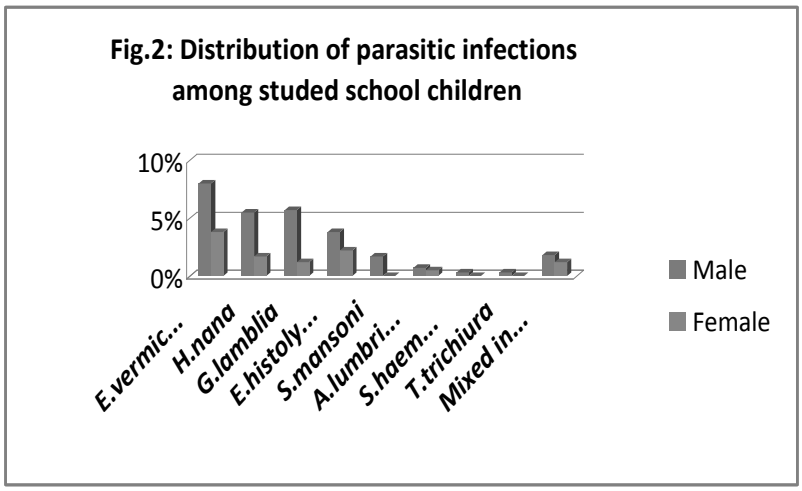


Fig.2: Distribution of parasitic infections among studed school children
10%
5%
0%
E.vermic...
H.nana
G.lamblia
E.histoly...
S.mansoni
A.lumbri...
S.haem...
T.trichiura
Mixed in...
Male
Female

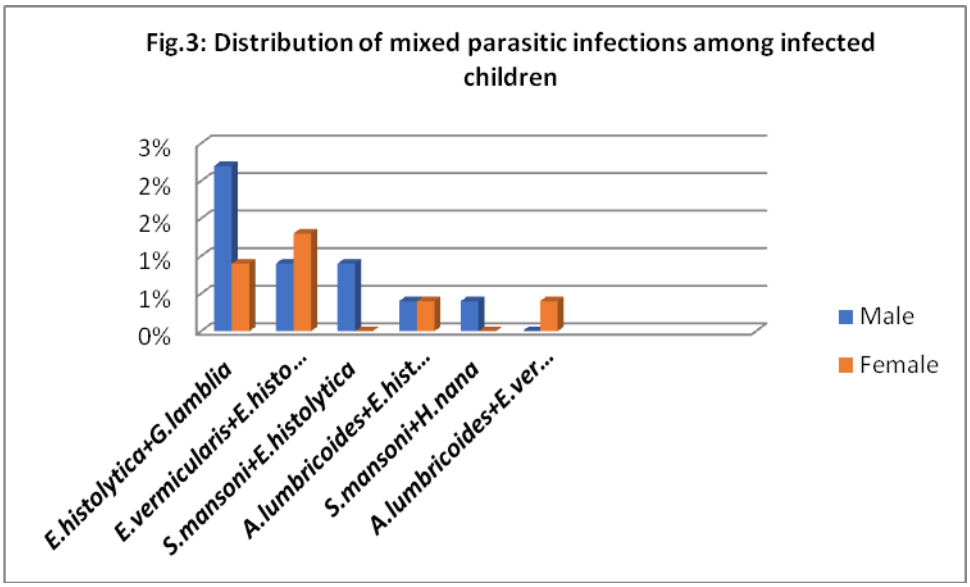


Fig.3: Distribution of mixed parasitic infections among infected children
3%
2%
2%
1%
1%
0%
E.histolytica+G.lamblia
E.vermicularis+E.histo...
S.mansoni+E.histolytica
A.lumbricoides+E.hist...
S.mansoni+H.nana
A.lumbricoides+E.ver...
Male
Female

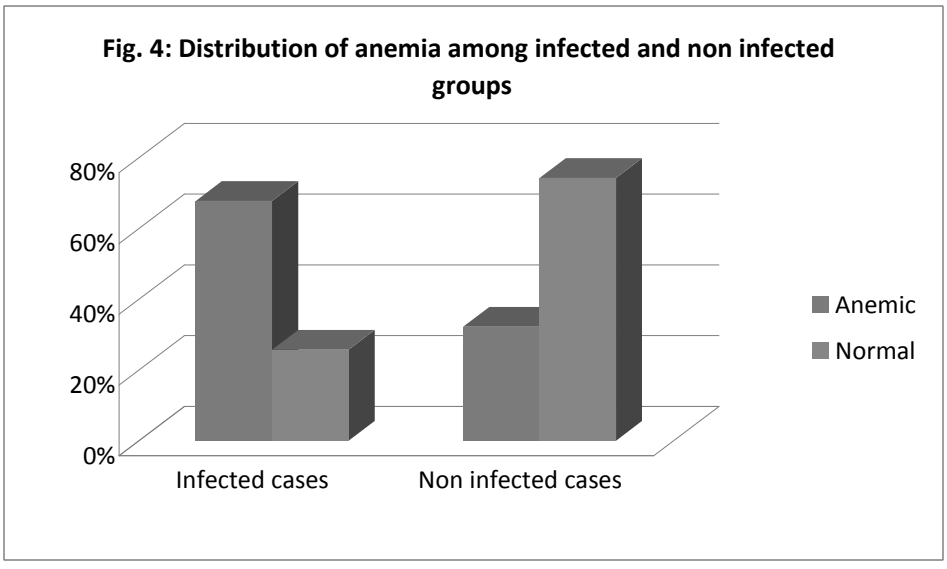
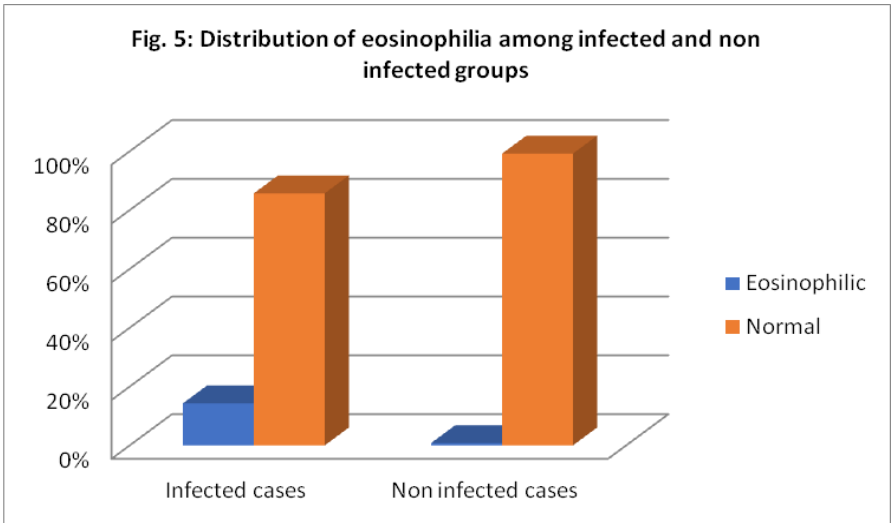


Fig. 4: Distribution of anemia among infected and non infected groups
80%
60%
40%
20%
0%
Infected cases
Non infected cases
Anemic
Normal



DISCUSSION

The worldwide prevalence of intestinal parasites is estimated to be more than 3.5 billion cases with around 4.5 millions of them were distributed mainly in tropical and subtropical regions including Egypt [9, 10]. So the present study aimed to estimate the prevalence rate of parasitic infection in two governmental primary schools in a rural area at Damanhour Center, Beheira Governorate, Egypt during the period from October, 2016 to April, 2017.

In the present study, the overall prevalence of parasitic infection was (38.3%) among 600 school aged children between 6-12 years. The prevalence rate of infection was (12.8%) for protozoal, (22.5%) for helminthic and (3%) for mixed infections and distributed as following: *G. lamblia* (6.8%), *E. histolytica/dispar* (6%), *E. vermicularis* (11.8%), *H. nana* (7.2%), *S. mansoni* (1.7%) and *A. lumbricoides* (1.2%) while, *T. trichiura* and *S. haematobium* had the same percentage of (0.3%). The present results are in agreement with several Egyptian studies as [11, 12] who found that (38.5%) and (39.1%) of school students in villages in Tahta District, Sohag (Upper Egypt) and El Wadi El Gadeed Governorates had parasitic infections, respectively. Also [13] reported a prevalence rate of (39.36%) for parasitic infections among children attending Abu-Reesh Hospital in Cairo. Lower results were obtained by [14, 15] who reported a prevalence rate of (33.5% and 30.7%) among school children in Alexandria and Damietta Governorates, respectively. Higher results were obtained by [16, 3, 17] who found prevalence rates of (51.8%), (55.7%) and (84.4%) in Beheira and Assiut Governorates, respectively. This difference of results can be attributed to the difference in socio economic standard, health education, personal hygiene and human excreta sanitary disposal among the examined localities.

Giardia lamblia was the commonest protozoan parasite detected (6.8%) which coincided with that reported by [18] while the prevalence rate of *E. histolytica/dispar* reached (6%). Its prevalence varies in different countries and is common in underdeveloped countries where amoebiasis is considered the third leading cause of death and about (10%) of the world population is estimated to be infected with this parasite [19]. Both of them remain the most common intestinal parasitic pathogens transmitted via fecal oral route either directly from person to person or indirectly by eating or drinking contaminated food and water [15]. The differences of prevalence in different locations may be attributed to different levels of sanitation, types of water supply, hygienic measures and food behaviors [20, 21].

E. vermicularis was the highest helminthic parasite found among all the examined children (11.8%) that coincided with [22, 11, 12]. This high prevalence can be attributed to improper hygienic habits including hand washing with soap after defecation and before eating or preparing food, the high infectious nature of the parasite and due to detection of eggs using NIH swab method which is more sensitive and accurate [23]. Eggs were detected during urine examination in three female children which can be explained as the gravid females lay their egg in the vulva and they are washed down by the stream of urine.

H. nana was the second helminth detected (7.2%) which coincided with that obtained by [24]

among primary school children (6-12 years) in El Santa City villages, Gharbia Governorate, Egypt. In the present study, the prevalence rate of *S. mansoni* and *S. haematobium* infections was (1.7%) and (0.3%), respectively and all infected children were males. *S. haematobium* infection was less than other reported by [11, 21] in Sohag and Assiut Governorates. *S. mansoni* infection was more prevalent than *S. haematobium* which in agreement with studies that reported *S. mansoni* has almost completely replaced *S. haematobium* in Lower Egypt but *S. haematobium* is spreading into Upper Egypt, where focal areas of transmission are present[25].

Infection of school children specially males can be explained as they come in contact with water canals for drinking, laundry, swimming and other domestic purposes [26] .The detected results, were coincided with [15, 27] who reported a prevalence rate of (0.9%) and (1.2%) in Damietta and Assiut Governorates, Egypt, respectively. On the other hand some studies reported higher prevalence rates as [25] who recorded (6.3%). The present results supported the success of National Bilharzial Control Program in Egypt in reduction of percentage of infection.

In the present study the prevalence rate for *A. lumbricoides* was (1.2%) which in agreement with [28, 12] where they reported the percentage as (1% and 1.3%) among school children in Aswan and El-Wadi El-Gadded Governorates, respectively. Lower rate was reported by [29] who reported (0.2%) in Sohag Governorate. The present results were lower than that obtained by [31, 15, 30, 16, 14] who recorded prevalence rate of (3.2%, 5.2%, 11.7%, 14% and 24.8%) among Egyptian school children in Minia, Damietta, Lower Egypt, Behiera and Alexandria Governorates, respectively. *T. trichura* infection had low prevalence rate of (0.3%) which was in agreement with [32] who reported a prevalence rate of (0.75%) in Qena Governorate, and was lower than reported by [17] (3.3%) in Beheira Governorate.

Mixed infection constitutes (7.8%) of the infected cases while, its distribution among all studied population reached (3%). The most common double infection was *E. histolytica/dispar* + *G. lamblia* (3%), *E. vermicularis* + *E. histolytica/dispar* (2.2%), *A. lumbricoides* + *E.histolytica/dispar* (0.9%), *S. mansoni* + *E.histolytica/dispar* (0.9%), *S. mansoni* + *H. nana* (0.4%) and *A. lumbricoides* + *E. vermicularis* (0.4%), without any multiple infections. The present results are in agreement with [27, 33] in Assiut Governorate who recorded (7.3%) as a prevalence rate for mixed double infection. High prevalence rates were reported by [30] (21.3%) and [14] (22.7%) as well as [11] (20.1%) and [21] (12.7%) in Lower Egypt, Alexandria, Sohag and Assiut Governorates, respectively. On the other hand, lower rates were reported by [12, 34, 28] (0.4%, 2.4%, 5.1%) in El-Wadi El-Gadded, North of the Delta and Aswan Governorates. This difference can be explained as the difference in examined localities.

Among all studied children, the prevalence of anemia was 41.8%, (67.8% of infected children compared to 25.7% in non-infected children) and eosinophilia was 6% (14.3% of infected group compared to 0.8% in non-infected ones).

In the total group of children, anemia was more common in males (27.5%) than females (14.3%) but without a significant association, while, among the infected group anemia was more common in males (67.3%) than females (52.3%) with a significant association **(P < 0.05).**

The results were in agreement with [27]. Among all the studied population in the present study; (34.7%) had microcytic hypochromic and (64.3%) had normocytic normochromic anemia while, among infected children (30.1%) had microcytic hypochromic and (69.9%) had normocytic normochromic anemia.

The relationship between anemia and parasitic infections especially protozoal ones caused by *G. lamblia* and/or *E. histolytica/dispar* was noticed in the present work where anemia associated with *G. lamblia* infection reached (70.7%). This percentage was higher than that reported by [35] (26.3%).

Also**,** [36] reported that, over one quarter (26.4%) of the Ecuadorian infected children were identified as having iron deficiency anemia specially those infected with *G. intestinalis*. The negative impact of *Giardia* and *E. histolytica/dispar* infections on child hemoglobin level was also noted in some studies as [14, 37] who linked *Giardia* and *E. histolytica/dispar* infections with significantly reduced mean hemoglobin level in children. Also, *S. mansoni* and *T. trichiura* are known to cause blood loss in the stool while, *S. haematobium* cause blood loss in urine, thus they are well recognized risk factors for anemia [38].

Eosinophilia was more common among infected cases (14.3%) than non-infected ones (0.8 %) with significant association **(P<0.05).**

This was in agreement with [39] .This can be explained as the eosinophils have the ability to destroy

the parasites through attachment to the parasitic wall and secretion of granules causing wall destruction.

CONCLUSION AND RECOMMENDATION

Although the prevalence rates of reported parasitic infections in the present study were nearly comparable with similar studies conducted in other parts of Egypt, the rates of infections are, however, of public health importance. So, it is recommended for early identification of clinical manifestations that may help in the early detection and treatment of parasitic infections. Also necessary sanitary strategies, health education, improving of socio-economic conditions, improving of personal hygienic measures including safe food and drink supplies, regular screening and treatment for parasitic infections must be in mind as control measures for parasitic infections.

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