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PREVALENCE OF GASTROINTESTINAL PARASITES IN SLUM CHILDREN OF DHAKA CITY: COMPARISON OF TWO COPROLOGICAL METHODS

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Abstract: The present study aimed to measure the prevalence of intestinal parasites among children with gastrointestinal tract infections from different slum areas of Dhaka. Furthermore, a comparison was made of the accuracy of direct smear (DS) and formol-ether concentration (FEC) techniques in the detection of infection. The overall prevalence of parasitic infection was 72.46% with a combined method. By direct smear, 2 species of protozoa (11.59%), 2 species of cestode (5.07%) and 4 species of nematode (18.12%) parasites were detected whereas by formol – ether concentration method, 5 species of protozoa (28.26%), 1 species of Trematode (1.44%), 2 species of cestode (17.39%) and 5 species of nematode (79.71%) parasites were detected. By direct smear (DS) and formol-ether concentration (FEC) the prevalence of intestinal parasites was 42% and 58% respectively. *Ascaris lumbricoides* was the most common parasite detected by both formol-ether concentration (37.68%) and direct smear method (7.97%). A statistically significant association ($P < 0.001$) was found between the test methods, age groups and months with parasitic infection. Direct smear showed less sensitivity than formol-ether concentration technique (100%). The diagnostic performance of formol-ether technique for the diagnosis of intestinal parasites in slum children was remarkably higher as related to direct smear in the present study. Therefore, the DS and FEC combined techniques should be used as routine investigative techniques for the identification of intestinal parasites. Henceforth, it is advantageous to use the formol-ether method to complement the direct smear method.

***Key words*:** Formol-ether concentration, direct smear, children, fecal, intestinal parasites**.**

INTRODUCTION

Intestinal parasitic infections are globally endemic and have been demonstrated as constituting the greatest single global cause of illness and disease. It is considered a severe public health problem, as they cause iron deficiency anemia, growth retardation in children, and other physical and mental health problems (WHO 1998). According to Chan (1997), about one-

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Third of the world, more than two billion people, are infected with intestinal parasites. Approximately 300 million people are severely ill with these worms and of those, at least 50% are school-age children. They are most prevalent in the poorest communities of developing countries (Bundy 1994). About 39 million disability-adjusted life years (DALY) are attributed to intestinal parasitic infections and these infections thus represent a significant socio-economic burden (Stephenson 2000).

Bangladesh is mostly a plain land surrounded by rivers and canals, and here soil humidity and temperature contribute a lot towards parasitic infection. Several studies showed that intestinal parasitic infections are present in all seasons everywhere in this country (Nuruzzaman and Huda 1974). The fertile soil and humid temperature all these things contribute in favor of nematode parasites like *Ascaris lumbricoides*, *Trichuris trichiura, Ancylostoma duodenale, Entarobius vermicularis, Necator americanus* and other helminth and intestinal protozoan parasites *Entamoeba histolytica* and *Giardia intestinalis*.

It has been established that the failure of children to accomplish their developmental potential milestones and attain satisfactory educational levels plays a key role in the inter-generational transmission of poverty *(*Grantham-McGregor *et al. 2007).* The relationship between the socio-economic condition of people and the infestation of parasites was examined by Huq and Shaikh (1975) where the prevalence of *Entamoeba histolytica* was 4.2%. Muttalib *et al*. (1976) reported that the prevalence of *E. histolytica* (55%) among the patients attending a private city clinic in Dhaka. Mekonnen and Ekubagewargies (2019) carried out a study among under-five children where the overall prevalence was 18.7%. All age groups were found affected by intestinal parasites but children who were at the age of below 2 years and at the age between 2 and 3 years were more susceptible (Gebretsadik *et al.* 2018).

Several techniques are described for fecal parasite identification. Some highly complex as well as expensive methods are used globally which cannot be affordable in developing countries like Bangladesh. Coprological methods like direct stool smear, formol-ether concentration method, and zinc floatation techniques are most convenient, reasonable and cost-effective than others for detecting intestinal parasites (Parija *et al*, 1999).

The microscopic examination for the various intestinal protozoa and helminth is difficult, insensitive, and requires trained personnel. The sensitivity of microscopy for the different parasites does not go beyond 60% even if concentration methods and skillful technical support are available (Hiatt *et al.* 1995). Now-a-days a number of concentration methods have been developed for the identification of numerous parasites' larvae, cysts and eggs directly from human feces.

The purpose of the present study is to determine the prevalence of the intestinal parasite among slum children with regard to the age group, sex, and

seasons and to compare the direct microscopy method and formol- ether concentration technique. This data may help the slum dweller and policy maker to take necessary steps to control the transmission of parasites.

MATERIAL AND METHODS

Study area and population: The present study was carried out in two slum areas of Dhaka city, viz. Mohakhali Slum and Kamrangir Chor Slum. A total of 138 fecal samples were collected from March 2019 to February 2020 of age groups 0-15 years of which 98 were from Mohakhali Slum and 40 from Kamrangir Chor Slum. The children were divided into the following four age groups: 0-3 years; 4-7 years; 8-11 years and 12-15 years. In addition, the demographic, and socio-economic conditions of the study household were noted in a questionnaire. Most of the mothers were cooperative. For every respondent, a serial number was maintained.

Sample collection and processing: Stool samples were collected in a stool pot in the morning between 9 to 12 A. M. and as soon as possible, these were carried to the Parasitology laboratory of the Department of Zoology, University of Dhaka. At first, fresh samples were examined for the direct smear method as early as possible. On the other hand, samples were processed by the formol-ether concentration method. The larvae, eggs and cysts were detected under the microscope and identified by (Chatterjee 1975, Chessbrough 1987, Schmidt and Roberts, 1989).

Data processing and analysis: Age group, sexes, months, and their relation with parasites were considered as parameters of the study. In all cases, P-values less than 0.05 were considered statistically significant. Data obtained from the samples were statistically analyzed using F- test and correlation coefficient.

RESULT AND DISCUSSION

A total of 138 stool samples of the children were examined and out of them, 100 samples (72.46%) were found infected. In Mohakhali slum, the overall prevalence of infection was 69.39% (52.94% in males and 47.05% in females) and in Kamragi Char slum the overall prevalence of infection was 80% (68.75% in males and 31.25% in females). (Table 1).

In the present study, *Ascaris lumbricoides* (45.65%) and *Trichuris trichiura* (33.33%) were the most prevalent, followed by *Giardia intestinalis* (23.91%), *Hymenolepis nana* (14.49%), *Entamoeba histolytica* (13.04%), *Ancylostoma duodenale* (10.87%), and *Taenia spp* (7.97) *Enterobius vermicularis* (5.06%), *Entamoeba coli* (2.90%), *Paragonimus westermani* and *Trichostrongylus spp.* (1.45%), *Trichomonas hominis* and *Balantidium coli* (0.72%) by two test methods. In direct microscopy, the highest (7.97%) and prevalence was found in both *G. lamblia* and *A. lumbricoides* and the lowest (1.48%) prevalence was found in *A.*

Table 1. Prevalence of total parasitic infections in the study population

Study area	Mohakhali slum			Kamrangi Char Slum			Overall		
	Total no. of sample	Positive case	Prevalence (%)	Total no. of sample	Positive case	Prevalence (%)	Total no. of sample	Positive case	Prevalence (%)
Male	54	36	52.94	26	22	68.75	80	58	58
Female	44	32	47.05	14	10	31.25	58	42	42
Total	98	68		40	32		138	100	

duodenale respectively. In case of formol – ether concentration method the highest (37.68%) prevalence was calculated in *A. lumbricoides* and the lowest (0.72%) prevalence was calculated in *B. coli.* This outcome is supported by a study carried out by Oguoma and Ekwunife (2006) where the infestation of parasites identified with formol - ether concentration technique was 65.25% while, the direct smear was 34.74% ($p<0.05$). This is also supported by another work by Amal *et al.* (2003), whose work showed 10.7% and 5.35% prevalence for formol - ether concentration technique and direct smear respectively. Statistical analysis (F value 5.03, p- value 0.036, $p< 0.05$) showed that the variation of prevalence by direct microscopy and formol – ether concentration method was significantly different at 5% significant level (Fig. 1).

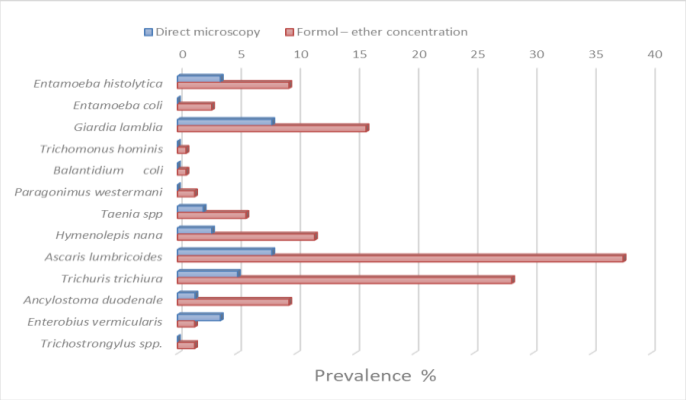

Fig.1. Comparison of prevalence of parasites according to two test methods.

Table 2. Prevalence of different groups of parasites identified in children

Group	No. of samples examined	Total Number of species identified	Direct microscopy		Formol–ether concentration method	
			Positive case	Prevalence (%)	Positive case	Prevalence (%)
Protozoa	138	5	16	11.59	39	28.26
Trematode		1	0	00	2	1.44
Cestode		2	7	5.07	24	17.39
Nematode		5	25	18.12	110	79.71

In the present study, 5 species of protozoa, 1 species of Trematode, 2 species of cestode and 5 species of nematode were detected. The highest prevalence (18.12%) was in Nematode and the lowest prevalence (5.07%) was in Cestode by direct microscopy, while by formol – ether concentration method the highest prevalence (79.71%) was found in Nematode and the lowest prevalence (1.44%) was found in Trematode which is incompatible with the previously published result (Matthys *et al.* 2011). Abbaszadeh *et al.* (2020) found the prevalence of protozoan parasites 32.3% was higher than helminthic parasites 3.2%. No Trematode parasite was found by direct microscopy (Table 2).

In case of direct microscopy, the highest prevalence (23.07%) was found in the age group 00-03 years and the lowest prevalence (9.09%) was found in age group 08-11 years. On the other hand, in case of formol – ether concentration method the highest prevalence (92.45%) was found in age group 08 - 11 years and the lowest prevalence (53.84%) was found in age group 12- 15 years whereas, in an investigation, Khanum *et al.* (2010) found lowest prevalence in 08- 10 years age group in an investigation. Statistical analysis showed that age group was not significantly associated at 5% level (P>0.05) with direct microscopy method (x^2 value 3.53, p–value 0.31) with parasitic infection. On the other hand, the age group was significantly associated at 5% level (P<0.05) with Formol–ether concentration method (x^2 value 18.74. p= value 0.0003) with parasitic infection (Fig. 2).

By direct microscopy, the highest prevalence (25.00%) was found in June 2019 and by formol- ether concentration method the highest prevalence (88.89%) was found in April 2019 while Amin (2002) found the highest prevalence (36- 43%) between July 2019 and October 2019 and gradually reduced to 32% during December 2019. F – test (F value 0.180, p-value 0.0042, p< .05) showed that the variation of monthly prevalence of parasites calculated by different test methods was significantly different at 5% level (Fig. 3).

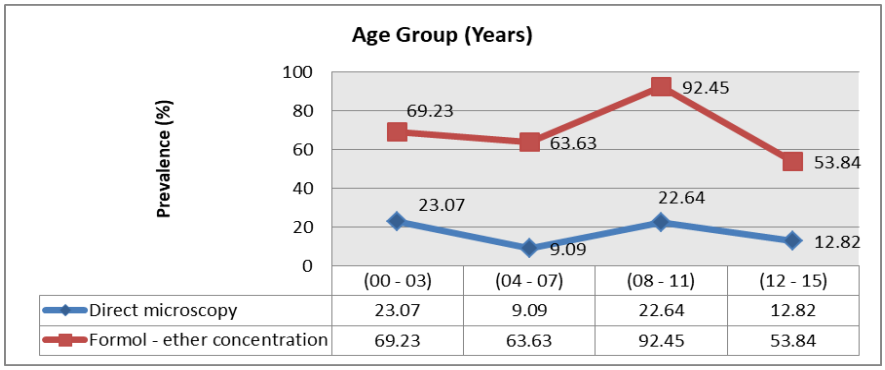

Fig. 2. The overall prevalence of parasites in slum children according to age group and test methods.

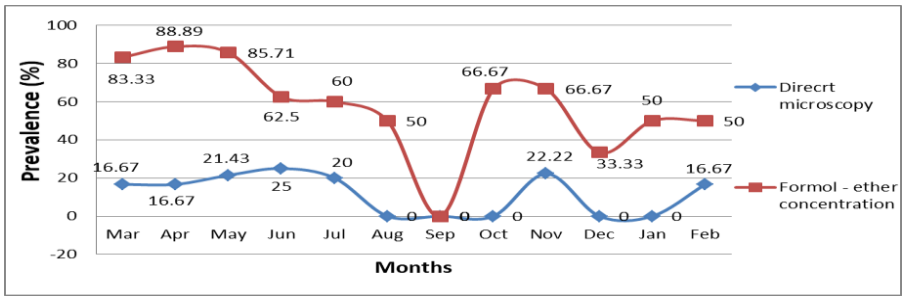

Fig. 3. Monthly prevalence of parasites according to two test methods.

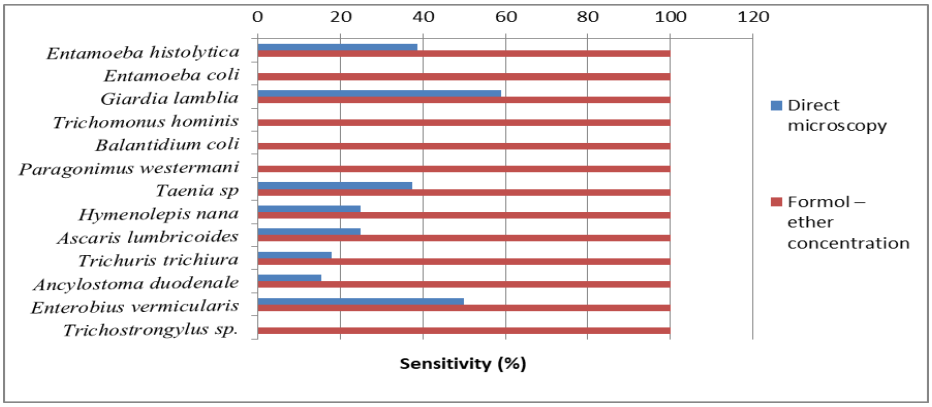

Fig. 4. Comparison of the sensitivity of direct microscopy and formol – ether concentration method for the diagnosis of intestinal parasites.

(Number of true positives/ [Number of true positives + Number of false negatives] × 100) (Baratloo *et al.* 2015)**.** When direct smear compared to formol ether concentration method 0% sensitivity showed in case of *Entamoeba coli, Balantidium coli, Paragonimus westermani, Trichomonus hominis & Trichostrongylus sp.* infection diagnosis though formol – ether concentration method identified 4, 5, 1, 2 & 2 cases of infections, respectively. Direct microscopy showed sensitivity for the diagnosis of *Entamoeba histolytica (*38.64%), *Giardia lamblia* (59.09%), *Taenia sp.* (37.50%), *Hymenolepis nana* (25.00%), *Ascaris lumbricoides* (25.00%), *Trichuris trichiura* (17.95%), *Ancylostoma duodenale* (15.38%) and *Enterobius vermicularis* (50%) in the study population. In contrast formol- ether concentration method showed 100% sensitivity to identify the parasites (Fig. 4) (Number of true negatives/ [Number of true negatives + Number of false positives] × 100) (Baratloo *et al.* 2015)

In case of specificity, direct microscopy was 100% specific for a total of 12 parasites except for *E. vermicularis* (97.14%) in the study population. Formol – ether concentration method showed specificity for the identification of the

*Entamoeba histolytica (*94.32%), *Entamoeba coli* (97.18%), *Giardia lamblia* (92.28%)**,** *Trichomonas hominis* (99.28%), *Balantidium coli* (99.28%), *Paragonimus westermani* (97.14%), *Taenia spp.* (97.14%,), *Hymenolepis nana* (91.78%), *Ascaris lumbricoides* (76.21%), *Trichuris trichiura (*80.36%), *Ancylostoma duodenale (*92.52%), *Enterobius vermicularis* (99.25%) and *Trichostrongylus spp.* (98.57%) (Table 3).

Table 3. Evaluation of the specificity of direct microscopy and formol–ether concentration method for detection of parasites in slum children

Parasites	Direct microscopy (%)	Formol – ether concentration (%)
Entamoeba histolytica	100	94.32
Entamoeba coli	100	97.18
Giardia lamblia	100	92.28
Trichomonas hominis	100	99.28
Balantidium coli	100	99.28
Paragonimus westermani	100	97.14
Taenia spp.	100	96.42
Hymenolepis nana	100	91.78
Ascaris lumbricoides	100	76.21
Trichuris trichiura	100	80.36
Ancylostoma duodenale	100	92.52
Enterobius vermicularis	97.14	99.25
Trichostrongylus sp.	100	98.57

CONCLUSION

The present study was carried out to find out the incidence of parasitic infections among slum children and to compare two coprological methods used for parasite detection. However, this study concentrated on only 138 children while one would expect many other protozoans and helminths in the same community. Clinically direct microscopy is widely used for the detection of intestinal parasites. Although this method is easy to operate and economically affordable, it lacks sensitivity, especially in case of low infection. Formol – ether concentration method is much more effective than direct microscopy. So, it is also recommended that diagnostic laboratories should use methods other than direct microscopy for elaborate parasitological investigation.

A further epidemiological study is essential to understand the distribution of different other parasites throughout the country and a mass campaign is necessary to develop awareness among different communities to combat this infection which has considerable economic significance.

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