Bioresearch Communications
Volume 02, Issue 02, July 2016.
Journal Homepage: www.bioresearchcommunications.com

Original Article

Diarrheal carriage illness with *Trichuris trichiura* among the slum dwelling children in Dhaka city

Hamida Khanum[1], Mandira Mukutmoni[2], Jashim Uddin[2] and Rashidul Haque[2]

[1]Department of Zoology, University of Dhaka, Dhaka-1000, Bangladesh[2]International Centre for Diarrheal Disease Research, Bangladesh (ICDDR, B), Mohakhali, Dhaka-1212, Bangladesh

ABSTRACT:A total of 417 diarrheal fecal samples from Mirpur slum area were collected from 127 children during June, 2014 to May, 2015. Multiplex PCR-Luminex method ensured that prevalence of *Trichuris trichiura* was 60.63% comprising 65.15% in male and 55.74% in female among diarrheal children. Children aged 9-10 months were exposed as the highest *T. trichiura* prevalent (38.81%) group including the highest infected female (34.48%). Age group 3-4 months showed the lowest (16.95%) prevalence. The topmost prevalence (58.33%) was observed among the male children aged 11-12 months. The highest prevalence of *T. trichiura* was observed in summer (31.85%)and the lowest in winter (21.17%). Peak prevalence was noticed in April (61.11%) and declined in December (14.29%). Overall mixed infections with *T. trichiura* was less frequent (14.96%). Double infection comprising *T. trichiura* and *Ascaris lumbricoides* was 5.51%. 11 children encountered diarrhea for seven to nine times and every single time they were marked as *T. trichiura* positive. The likelihood of *T. trichiura* infestation was significantly ($p<0.05$) associated with diarrhea. The current findings suggest that *T. trichiura* infections remain a persistent health problem among children in Bangladesh and need appropriate prevention and control measures.

KEYWORDS:*Trichuris trichiura*, Diarrhea, PCR-Luminex, Prevalence, slum children.

CITATION: Khanum, H., Mukutmoni, M., Uddin, J., Haque, R. 2016. Diarrheal carriage illness with *Trichuris trichiura* among the slum dwelling children in Dhaka city. *Biores Comm.* 2(2), 254-258.

CORRESPONDENCE: Hamida Khanum, E-mail: hamida_khanum@gmail.com

INTRODUCTION

Acute diarrheal diseases remain to be one of the major causes of morbidity and mortality in the developing world such as Bangladesh where one in ten children die before their fifth birthday (Dillingham *et al*. 2004; Checkley *et al*. 2004; Guerrant *et al*. 2003)[1-3]. Regardless of the vast life-saving use of oral rehydration therapy, however, the morbidity connected with diarrheal diseases in developing tropical areas remains mostly persistent and with accelerating advance among underprivileged populations (Kosek *et al*. 2003)[4]. A number of bacterial, viral, and parasitic agents have been identified in patients with acute diarrhea. At least 2200 million people in the world suffer from one or more type of helminths infection (de Silva *et al*. 2003)[5] and Bangladesh covers quite a large group. Infection is most prevalent among children.

Trichuris trichiura, a nematode, is a common gastrointestinal parasitic agent. Infections with *T. trichiura* reach the highest prevalence in Central Africa, southern India and Southeast Asia. It is estimated that 600-800 million people are infected worldwide with *T. trichiura* and 3.2 billion individuals at risk (Bundy and Cooper, 1989)[6].

Concomitant infections with more than one helminth are the average rather than the exception. This is particularly true of co-infection by *A. lumbricoides* and *T. trichiura*, possibly because both of these worms tend to infect individuals in the domestic or peri-domiciliary domain (Petney and Andrews, 1998)[7] in and around the home. Ahmed and Talukder (2002)[8] found the prevalence (39%)

of *T. trichiura* among the children from rural and urban areas of Bangladesh.

Actually, infestation of helminth parasites such as *A. lumbricoides* and *T. trichiura* is a major public health problem both in rural and urban areas with an endemicity in Bangladesh (Khanum *et al*. 1998)[9]. Although the majority of *T. trichiura* infected individuals remain asymptomatic, a significant number of trichuriasis patients, especially children with long-standing massive infections, have dysenteric syndrome presenting with chronic mucous diarrhea, rectal prolapses, anemia from chronic blood loss and iron deficiency, protein-energy malnutrition, and growth retardation (Stephenson *et al*. 2000)[10].The rate of infection is much complex due to over-population, climatic appropriateness of the parasites, depressed socio-economic conditions of the people, involuntary sewage system etc. Additionally, malnutrition and lack of cognizance among people correspondingly worsen the situation. The condition can be further alarming if left untreated (Muttalib, 1976; Huq *et al*. 1982)[11-12]. The species-specific efficacies of anthelmintics used in treatment program could pose problems for helminth control initiatives because the removal of one helminth species via chemotherapy could possibly provide an advantage to any other less susceptible species.

Trichuriasis in children under 5 years of age seemed to be directly related to the mother's knowledge about sanitation and cleanliness. As children are at the highest risk of morbidity due to trichuriasis, it may be of particular significance to the well-being of urban slum populations. The aim of the present study was to identify the prevalence of *T. trichiura* among the underprivileged diarrheal children of urban slum area and to understand seasonal and gender based prevalence rates; finally, to depict a definite picture showing the rate of infection of *T. trichiura* in an underprivileged urban area. It is expected that the findings obtained from the present study will enhance more intervention in related research.

MATERIALS AND METHODS

Study design

The present study was conducted among children, aged 1-12 months of Mirpur (Sector-11, avenue-5), an urban slum area. The period of study was from 1st June, 2014 to 31st May, 2015. 417diarrheal fecal samples from 127 children were tested for the study. Samples were stored at 4°C for not more than 7 days.

Molecular screening

Stool DNA was extracted by using QIAamp® DNA Stool Mini Kit (QIAGEN). DNA was eluted in low-salt buffer and was free of protein, nuclease, and other impurities or inhibitors. The purified DNA was ready for use in PCR and other enzymatic reaction. Inhibit Ex efficiently absorbs these substances early in the purification process so that they can easily be removed by a quick centrifugation step. The kit contained buffer ASL, which was specially developed to remove inhibitory substances from stool samples. Multiplex PCR reactions with target specific primers for helminths were performed using fecal DNA template. Internal oligo-nucleotide probes were designed and covalently linked to uniquely color fluorescent beads. After amplification, the PCR products were hybridized to the beads, and the mixture interrogated on a Luminex liquid array platform. Fluorescent units associated with each bead signature were reported, representing a measure for each amplicon quantity (Table 1). In multiplex PCR for the Luminex assays either the forward or the reverse primers was biotinylated on the 5′-end. Internal probes are amine modified at the 5′-end and included 12 carbon spacers.

Table 1.*Trichuris trichiura* specific primer-probe used in present study.

Species	Target			Sequences for primers and probes	
	Gene	Amplicon	Fluorophore	Name	Sequence (5′ → 3′)
T. trichiura	18S rRNA	76 bp	CY5	Tt283F Tt358R*	ATAACAGCGTGCACATGTTGC [BioTEG]CTGTTTGTCGAACGGTACTTGC

Statistical analysis

Statistical package, SPSS version 16 was used to compare the prevalence of infection between groups using $\chi 2$ statistics. Values of $p<0{\cdot}05$ were considered statistically significant.

RESULTS AND DISCUSSION

The present study demonstrates a current burden of early childhood diarrheal illnesses and allied *T. trichiura* prevalence among urban slum dwelling children in Dhaka city. Out of 127 diarrheal children, 66 were male and 61 were female. Overall prevalence of *T. trichiura* was 60.63%; 65.15% in male and 55.74% in female (Table 2). To some extent, the sex predominance for parasite infection is still not confirmed. According to Rao *et al.* (2003)[13], parasitic infection was higher in males and according to Yong *et al.* (2000)[14], it was higher in females. Khanum *et al.* (1998)[9] studied and combined total 400 cases in the four slum areas of Dhaka division and found that *A. lumbricoides (*52.58%) and *T. trichiura* (27.23%) were more prevalent in male than in female children.

Out of 127 children, total 77 children were found positive for *T. trichiura*. Highest number of diarrheal samples were collected from the children aged one to two months (Table 3). At the age of 01-02 months the *T. trichiura* prevalence was 17.28%; 13.16% in male and 20.93% in

female. The prevalence was the lowest (16.95%) among the children aged 03-04 months. The highest prevalence was 38.81% and observed among the children aged 09-10 months. Furthermore, female children of this age group was the uppermost prevalent group among females (34.48%). Among the male children of age group 11-12 months, the prevalence was the topmost; 58.33% (Table 3). Roy *et al*. (2011)[15] stated that there are limited data on the age based pattern of helminth infestation, association between diarrhea and helminth infestation or a diarrheal carriage of helminths in children aged under two years. Khanum *et al.* (2001)[16] observed 15.30% *T. trichiura* among the 2-16 years of subjects from lower income families of Dhaka city.

Table 2.*Trichuris trichiura* prevalence among the slum children according to sex.

Sex	Total children	No. of infected	Prevalence (%)
Male	66	43	65.15
Female	61	34	55.74
Combined	127	77	60.63

Table 3. Prevalence of *Trichuris trichiura* according to age groups of the slum children.

Age group	Male			Female			Combined		
	Sample examined	Infected	Prevalence (%)	Sample examined	Infected	Prevalence (%)	Sample examined	Infected	Prevalence (%)
01-02	38	5	13.16	43	9	20.93	81	14	17.28
03-04	28	4	14.29	31	6	19.35	59	10	16.95
05-06	37	9	24.32	22	6	27.27	59	15	25.42
07-08	41	10	24.39	28	6	21.43	69	16	23.19
09-10	38	16	42.11	29	10	34.48	67	26	38.81
11-12	12	7	58.33	18	0	0	30	7	23.33

Seasonality

The range of prevalence according to months was 8.11% - 61.11%. The highest prevalence was observed in April (61.11%) and the lowest in June (8.11%) (Fig. 1). Variation of prevalence of *T. trichiura* in different months were not statistically diverse (F-value 1.876, p-value = 0.185, p > 0.05). Kumar *et al*. (2014)[17] revealed seasonal variations in the prevalence of intestinal helminth, with the highest prevalence (80.5%) in autumn (Mid-September to mid-November) and lowest (43.9%) in the months of spring (February to March).

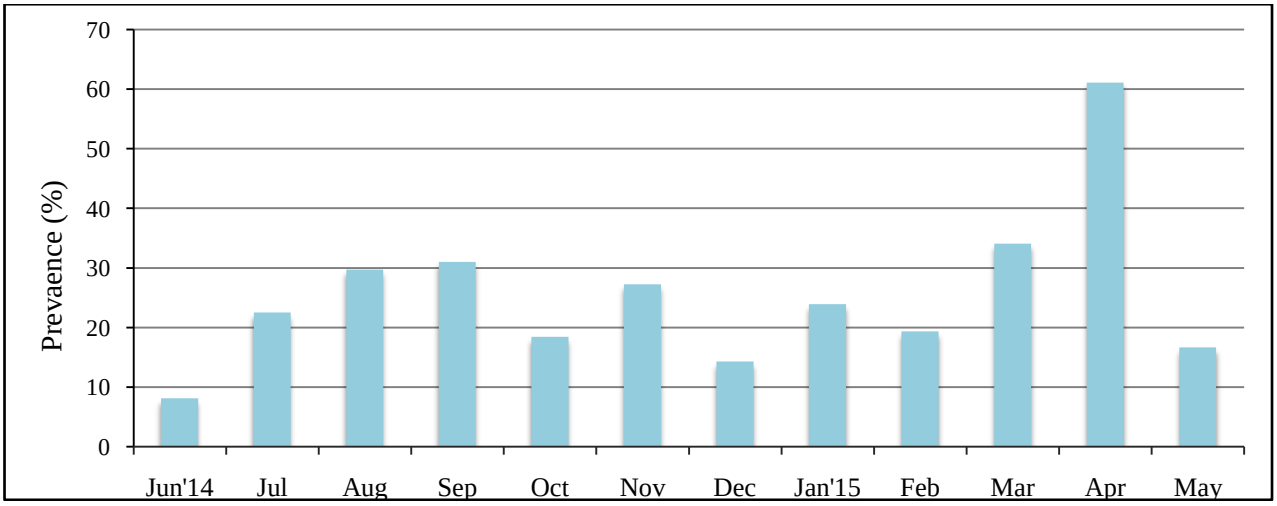

Fig. 1. Monthly prevalence of *Trichuris trichiura* among the slum children.

In the present study, the incidence of diarrhea did not show any marked seasonality. The highest prevalence was 31.85% and it was in summer season comprising the maximum prevalent male sufferers (42.65%). In the rainy season, the highest number of females were found positive (25%) for *T. trichiura*. (Table 4). In Aurangabad, India, a study by Avhad *et al*. (2012)[18] showed that the highest prevalence of helminths was recorded in rainy season (8.59% to 25.69%) while lowest in summer months (1.96% to 8.59%).

Mutiple infections

Khanum *et al.* (1999)[19] reported the prevalence of mixed infection of *A. lumbricoides* and *T. trichiura* were 15.25% among 400 children of four slum areas in Dhaka city. In the present study, mixed infection was less prevalent. Only 19 children among 127 showed mixed infection and prevalence was 14.96%. Double parasitic infection comprising *A. lumbricoides* and *T. trichiura* was the highest showing 5.51% of prevalence (Fig. 2). Ahmed *et al*. (2013)[20] found 26.31% double parasitic infection of *A. lumbricoides* and *T. trichiura* among the hospitalized children of 0-60 month's age group in Mohakhali, Dhaka.

Table 4. Seasonal prevalence of *Trichuris trichiura* among the slum children.

Seasons	Sex	Total sample examined	No. of infected	Prevalence (%)
Winter (November-February)	Male	87	19	21.84
	Female	51	11	21.56
	Combined	138	30	21.74
Summer (March-June)	Male	68	29	42.65
	Female	67	14	20.90
	Combined	135	43	31.85
Rainy (July- October)	Male	72	18	25.00
	Female	72	18	25.00
	Combined	144	36	25.17

(AD=*Ancylostomaduodenale*, AL=*Ascaris lumbricoides*, NA=*Necator americanus*, SS=*Strongyloides stercoralis*, TT=*Trichuris trichiura*)

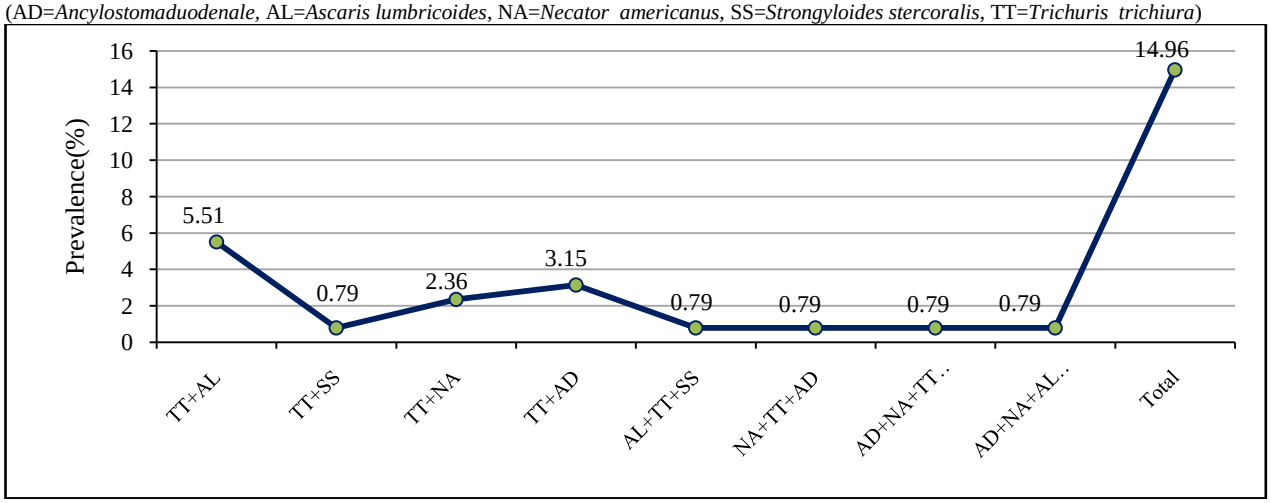

Fig. 2. Prevalence of mixed infection with *Trichuris trichiura*

In the present study, the prevalence of *T. trichiura* was 60.53% among the children who encountered one to three times diarrhea, 92.50% among the group who experienced four to six times diarrheal episodes in one year and 100% among the children who experienced diarrhea for seven to nine times (Table 5). Roy *et al*. (2011)[15] showed that 70% intestinal helminths were found among the children of rural Mirzapur, Tangail and amongst them 22.5% were associated with diarrhea. Likelihood of *T. trichiura* infestation was significantly ($p<0.05$) associated with diarrhea (Table 6). It is visibly predictable that moderate number of children had diarrhea for several times but those who had experienced this condition were harboring uncomfortable whipworm burden.

Table 5. Frequency of diarrhea and *Trichuris trichiura* prevalence.

Frequency of diarrhea	Total children observed	Number of children infected with *T. trichiura*	Percentage (%) of *T. trichiura*
01 – 03	76	46	60.53
04 – 06	40	37	92.5
07 – 09	11	11	100

Table 6. Pearson's Correlations between frequency of diarrhea and *Trichuris trichiura* infection.

		Diarrhea	*T. trichiura* infection
Diarrhea	Pearson Correlation	1	.884
	Sig. (2-tailed)		.003
	N	127	127
T. trichiura infestation	Pearson Correlation	.884	1
	Sig. (2-tailed)	.003	
	N	127	127

Even though intestinal nematode parasites have been disseminated to remain in children with diarrhea showing higher prevalence but may not necessarily mean that the parasites detected are the sole etiology of the discomfort.

However, high prevalence of recurrent diarrhea and high burden of intestinal nematodes at diarrheal condition indicate the underprivileged living conditions and low standards of sanitation in society which calls for long term control measures through improving the sanitary and living conditions and handling the infected individuals.The impact of preventive or control measures can be further enhanced through an organized health education programs which will inspire healthy behavior and lead to reduction in parasite infestation and morbidity. Understanding of helminth ecology and the accessibility of low cost drugs; goal to abolish intestinal helminthiasis as a public health problem. Regular surveys regarding the prevalence of intestinal parasites in hospitals and communities should be encouraged as these surveys not only give an estimate of prevalence of particular parasite, but also serve as an index of the community progress towards effective improvement measures.

ACKNOWLEDGEMENTS

We express gratitude to all the children along with their legal guardians for providing the samples. We are also thankful to all the members of the Parasitology Laboratory at the International Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR,B). This work was funded by Ministry of Science and Technology, Government of Bangladesh and we are indebted for providing unrestricted support.

REFERENCES

1. Dillingham, R. & Guerrant, R. L. 2004. Childhood stunting: measuring and stemming the staggering costs of inadequate water and sanitation. *Lancet.* **363**: 94–5.
2. Checkley. W., Gilman, R. H. & Black, R. E. 2004. Effect of water and sanitation on childhood health in a poor Peruvian peri-urban community. *Lancet*. **363**: 112–8.
3. Guerrant, R. L., Carneiro-Filho, B. A. & Dillingham, R. 2003. Cholera, diarrhea, and oral rehydration therapy: triumph and indictment. *Clin Infect Dis*. **37**: 398–405.
4. Kosek, M., Bern, C. & Guerrant, R. L. 2003. The global burden of diarrheal disease, as estimated from studies published between 1992–2000. *Bull WHO*. **81**: 197–204.
5. De Silva, N., Brooker, S., Hotez, P., Montresor, A., Engels, D. & Savioli, L. 2003. Soil-transmitted helminth infections: updating the global picture. *Trends Parasitol*. **19**: 547-51.
6. Bundy, D.A.P. & Cooper, E.S. 1989. *Trichuris* and trichuriasis in humans. *Adv. Parasitol*.**28** :107–173.
7. Petney, T.N. & Andrews, R. H. 1998. Multiparasite communities in animals and humans: frequency, structure and pathogenic significance. *International Journal of Parasitology*.**28**: 377-393.
8. Ahmed, S. & Talukder, K. K. 2002. Knowledge, attitude and practice of environmental sanitation and personal hygiene of school children in rural Bangladesh. Environmental threat to the health of children: Hazards and vulnerability, Bangkok**,** Thailand 3-7.
9. Khanum, H., Islam, N.&Dhar, T. 1998. Prevalence of *Ascaris lumbricoides* and *Trichuris trichiura* among the children of four slum areas of Dhaka city. *Univ. J. of Zool. Raj. Univ.* **16**: 89-94.
10. Stephenson, L. S., Holland, C. V. & Cooper, E. S. 2000. The public health significance of *Trichuris trichiura*. *Parasitology*. ***121***(*suppl*): 73-95.
11. Muttalib, M.A., Islam, N. & Islam, S. 1976. Prevalence of intestinal parasites in rural children of Bangladesh. *Bangladesh Med. J.***5**: 4-11.
12. Huq, N. M. & Shaikh, A. 1982. Incidence of intestinal parasite in children of different Socio economic population of Dhaka city, Bangladesh. *Medical Research Council. Bull*. **11**: 1-7.
13. Rao, V. G., Aggrawal, M. C., Yadav, R., Das, S. K., Sahare, L. K., Bondley, M. K. & Minocha, R. K. 2003. Intestinal parasitic infections, anaemia and undernutrition among tribal adolescents of Madhya Pradesh. *Ind. J. CommunityMed*. **27**: 26-29.
14. Yong, T. S., Sim, S., Lee, J., Ohrr, H., Kim, M. H. & Kim, H. 2000. A small scale survey on the status of intestinal parasitic infections in rural villages in Nepal. *KoreanJ. Parasitol*. **38**: 275-277.
15. Roy, E., Hasan, K. Z., Haque, R., Siddique, A. K. & Sack, R. B. 2011. Patterns and risk factors for helminthiasis in rural children aged under 2 in Bangladesh. *SA Journal of Child Health*. **5(3)**: 78-84.
16. Khanum, H., Islam, M. N. & Nahar, K.N. 2001. Intestinal nematode infection among children of lower income group employers in Dhaka city. *Bangladesh J. Zool.* **27**:177-183.
17. Kumar, H., Jain, K. & Jain, R. 2014. A study of prevalence of intestinal worm infestation and efficacy of anthelminthic drugs. *Med. J. Armed Forces India*. **70**: 144-148.
18. Avhad, S. B., Wahule, V. K. & Hiware, C. J. 2012. Effect of climate factors on the prevalence of intestinal helminths from Aurangabad district, India. *Int J Basic Appl Res*. **2(2)**: 49-55.
19. Khanum, H., Chawdhury, S. & Bhuiyan, Z. J. 1999. Infestation of three intestinal worms in children of three selected areas, Bangladesh**.** *Pakistan J. of Zool.* **31(4)**: 391-396.
20. Ahmed, T., Khanum, H. & Hossain, A. 2013. Prevalence of *Trichuris trichiura* among the children of age under five years. *Bangladesh J. Zool*. **41(1)**: 97-103.