ISSN 2394–806X (Print), ISSN 2454-5139 (Electronic)
IJHRMLP, Vol: 02 No: 01 January, 2016
Printed in India

ORIGINAL PAPER

High Prevalence of Intestinal Helminthiasis in a Densely Populated Urban Informal Settlement from Northeast India

Deka Sangeeta[1], Kalita Deepjyoti[2], Hazarika Naba Kumar[3]

***Received** on 26 June, 2015**; first review** on 27 July, 2015; **accepted** on July 30, 2015*

ABSTRACT

Helminthic infection is a common yet much neglected problem worldwide. Just like any underdeveloped/ developing region, prevalence of this infection in North Eastern part of India is suspected to be high. This is so, given the fact that slum like area with unhygienic living condition, where geo-helminths thrives especially in children, are in existence in urban areas here. Yet no published data, to the best our knowledge, on this condition is available from this region. About 93 stool samples from under five children were collected from a thickly populated underserviced urban informal settlement situated in the heart of an North-East-Indian City. Samples were processed at a tertiary care teaching Institute for detection of parasitic elements employing standard microbiological techniques. 52.7% samples yielded helminthic ova and significant proportion (42% of total detection) were with multiple parasitic infections. Statistically significant association could be found between helminthic infection as well as factors like mother's education (lack of it), absence of filtration or boiling in drinking water, age more than 2 years etc. Predominant detectable helminths were Ascaris lumbricoides (43% cases) and Trichiuris trichiura (30% cases) besides few other parasites. An overall need of improvement in sanitation, deworming and health education to the susceptible people seemed to be the need of the hour.

***Keywords:** Helminths, Geo-helminths, Helminthiasis, Slum area, Slum-like area, informal settlement, Ascariasis, Round worm, Trichiuriasis, Whip worm, Hookworm, under 5 children, Enterobiasis*

INTRODUCTION

Parasitic infections, especially helminthic infection in the intestine are amongst the commonest infectious disease, especially in less developed part of the world. Some 3.5 billion people are estimated to be affected, while 450 million are clinically ill, majority being children, as a result of this problem.[1, 2] Area of major concern are resultant iron deficiency anemia, growth retardation in children and other physical and mental health conditions, all of which are public health issues especially in underdeveloped countries.[2, 3,4,5] The prevalence of these infections is presumed to be connected with poverty, poor hygiene, lack of education, inadequate health services, etc.[6,7]

The feco-oral route is significant in the transmission of helminthic infections to human via poor personal hygiene and environmental conditions, principal incriminating factors being contaminated soil and water sources.[1]

Older global estimates of prevalence of intestinal helminthiasis, {e.g. Chan et al (1997) with 24% *Ascaris*

Address for correspondence and reprint:
[1]Demonstrator
[2]Assoc Professor (**Corresponding author**)
Dept. of Microbiology, Fakhruddin Ali Ahmed Medical College, Joti Gaon, Barpeta-01, Assam
Email: dkalita@gmail.com
Mobile: 09864064072
[3] Prof. and Head, Dept. of Microbiology, Gauhati Medical College

lumbricoides, 17% *Trichuris trichiura*, 24% hookworms, etc.) are believed to remain more or less unaltered, especially in under developed regions.[1,2] This is despite advances in technology, emergence and re-emergences of newer agents, world ecology, human demography and human behavior. Lack of recognition of these agents partly may be attributable to lack of any serious illness, excepting rare occurrences of Ascaris induced intestinal obstruction or Trichuris dysentery syndrome. [1, 2] However when all the disability consequences are considered together, it is the nonspecific effects on moderately infected people that carry the higher overall disease burden. (As measured by DALY or Disability Adjusted Life Years estimates).[1, 2]

In India, disadvantaged children are the most affected, especially those who live in slum areas.[8,9] World Health Assembly (administrative wing of health related issues within World Health Organization) member states were urged to implement regular, non selective deworming of school age children and young women in areas where the prevalence of worm infestation is 50% or more.[10] Currently, published data regarding the prevalence of parasitic infections or helminthic infection from North Eastern part of India about very much scarce. Hence little information is available in the current scenario of this infection locally. The study was carried out to fill that gap. The aim of this study was to determine the prevalence of intestinal helminthiasis in under five years age group of a densely populated and under-serviced urban informal settlement in the heart of Guwahati City.

MATERIAL AND METHODS

This study was carried out from February 2008 to July 2008 in a densely populated, underserviced informal human settlement on either side of the main railway track of Guwahati city. Subjects were continuously selected from each and every possible consenting household containing under five years age children. All children on breast feeding were excluded from the study.

Socio-economic and epidemiologic data were collected by means of a structured questionnaire, which mainly covered areas like (i) socio-demographic data: age, sex and residence; (ii) environmental factors: Occupation and education level of the parent's, number of rooms and people in the house, if there was any toilet (& type) in the house, household water source and hygiene practices (washing of hands after using toilet); (iii) personal complaints if any: Lack of appetite, abdominal pain/ distention, perianal itching and history of parasitic infections and treatment, etc.

All children were evaluated by standard anthropometric measurements (weight, height or recumbent length, mid-arm circumference) to find out the presence of Protein Energy Malnutrition as defined elsewhere.[11]

A stool collection container with the name of the selected subject was handed over to the guardian for stool collection and in the next-day our team member carry it to the Dept. of Microbiology, preferably within 2 hours of defecation.

Specimen were processed for direct saline mount as well as concentrated by the sedimentation technique of Formol Ethyl Acetate technique as per standard recommendation.[12,13] After concentration a drop of sediment was examined by placing a cover slip over it. One Microbiologist and an experienced technician examined the preparations under 10X and 40X dry objective (with 10X eye piece) and recorded the results with mention of type (ova, Proglottids, etc.), number (no/ hpf), species etc. Quality control was ensured by split sampling and parallel staining of known positive samples of fecal parasites.[12,13]

Significance between the prevalence of intestinal parasites and socioeconomic status (as well as other relevant factors) was determined using standard statistical methods like Fisher's exact test for estimation of two tailed p-value, etc.

RESULTS

Out of 131 subjects fulfilling inclusion criteria, 93 provided stool samples among which 42 were males and 51 females (**Table 1**). Mean age of participants were 3 years.

Table 1 Salient feature of subjects

Feature	Numbers	comment
No of participants	131	Male: 69 Female: 62
Participants providing stool sample	93	Male: 42 Female: 51
Stool samples showing ova of helminthes	49/93	Male: 23 Female: 26
Single helminthic ova detected in	28 samples	28/49
Double helminthes detected in	18 samples	18/49
Triple helminthes detected	3 samples	3/49

Out of 131 total respondents, stool sample could be collected from 91 subjects. In about 49 (49/93) stool samples, parasitic elements (all in the form of Ova) could be detected with infection rate being 52.7%. There were 21 cases (21/49, i.e. 42.9%) with poly-helminthic (2 or 3 parasites in same host) infection (**Table 1**).

Table 2 Profile of helminthes detected (all in the form of ova)

Helminth & Combination	**Positive Samples**	**Male: Female ratio (Subject population)**
Ascaris lumbricoides	19	9:10
Trichuris trichiura	7	5:2
Hook worms	1	0:1
Enterobius vermicularis	1	0:1
Ascaris lumbricoides + *Trichuris trichiura*	18	9:9
Ascaris lumbricoides + Hookworm+ *Trichiuris trichiura*	2	0:2
Ascaris lumbricoides + *Enterobius vermicularis* + *Trichiuris trichiura*	1	0:1

Table 2 vividly depicts the profile of parasites detected. *Ascaris lumbricoides* emerged as the predominant helminth i.e. 19 in single detection and 21 as part of poly helminthiasis cases implying a total 40 detection out of 49 positive samples (**Figure 1, 2, 3, 4**). Overall prevalence was 43% (40/93). Similarly *Trichuris trichiura* (eggs in **Figure 5, 6**) was second with 7 in single parasite detection cases and 21 in poly-parasitoses cases (total 28 out of 49 cases). Prevalence rate was estimated to be 30% for this helminth. Few cases of Hook worm (**Figure 7**) and *E vermicularis* were also detected.

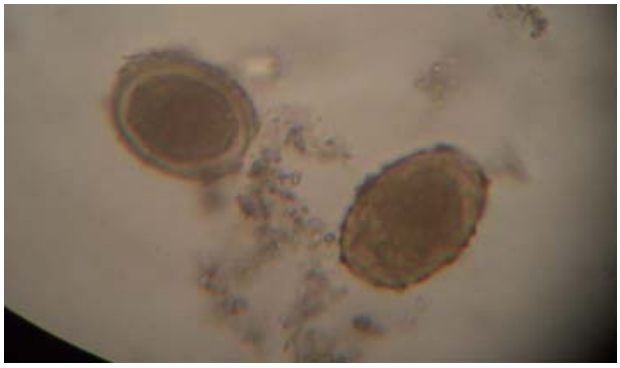

Figure 1 Roundworm: Ascaris lumbricoides (multiple eggs in 40X objective)

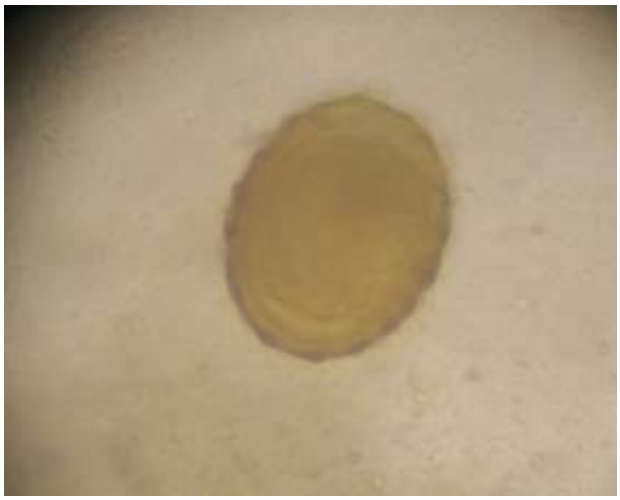

Figure 2 Roundworm single egg (40X objective)

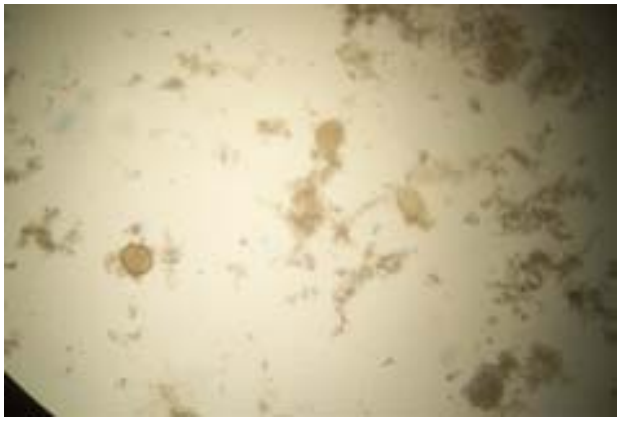

Figure 3 Multiple Ascaris egg in same field: Severe infection (10X objective)

Figure 4 Unfertilized Ascaris lumbricoides egg (40X)

Figure 5 Trichuris trichiura (whip worm egg) (40X)

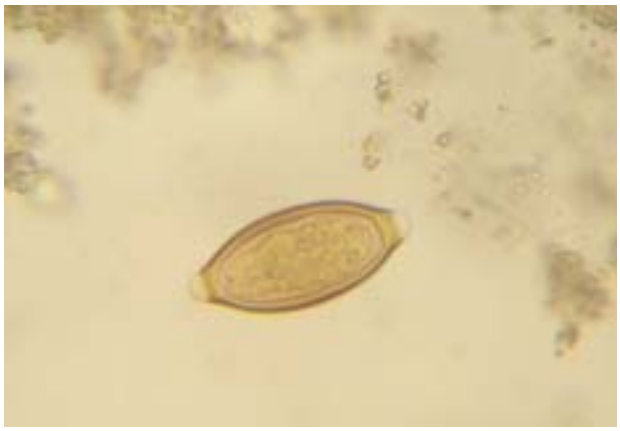

Figure 6 Whipworm egg (40X)

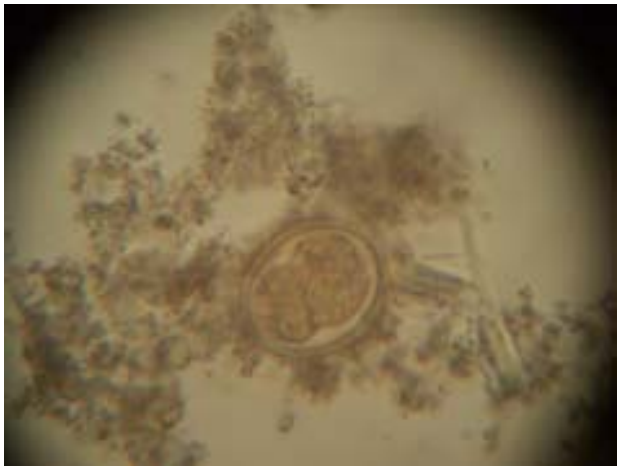

Figure 7 Hookworm egg (40X)

Table 3 Socioeconomic and other factors

	No of Cases (Tested)	Positive	Negative	Percentage	P-Value
Age					
Below 2 yrs	21	5	16	23.8	0.0031
≥2 – 5 yrs	72	44	28	61.1	
Sex					
Male	42	23	19	54.8	0.8351
Female	51	26	25	51	
Mother's education					
Educated (primary school completed or above)	32	8	24	25.8	0.0002
Un-educated: (illiterate or some school)	61	41	20	67.2	
Family size					
≤4	29	13	16	44.8	0.3722
≥5	64	36	28	56.3	
Excreta Disposal					
Home	15	7	8	46.7	0.7788
Open air/other	78	42	36	53.8	
Filtration/ boiling of Drinking water					
Yes	18	4	14	22.2	0.0073
No	75	45	30	60.0	

Different socioeconomic and socio-demographic factors were analyzed for statistical significance with helminthic infection. Fisher's exact t-test was utilized and two-tailed p-value was calculated for checking the significance. Table 3 clearly shows statistically significant relation between helminthic infection and factors like age group above 2 years, uneducated mother, absence of filtration or boiling of drinking water, etc. Factors like unhygienic excreta disposal, large family size, etc., came out to be statistically non-significant.

An important finding of the study was the presence of Poly-helminthiasis in quite a number of samples (21/49 i.e. 42.9%).

DISCUSSION

This study revealed that 52.7% of the subject population is infected with intestinal helminths predominantly *Asacris lubricoides* and *Trichuris trichiura*. Given this rate of prevalence and extreme unhygienic condition of the dwellers, it could be a potential source of intestinal helminthiasis in other population as well. This rate is quite high compared to studies like Awasthi et al [8] with 17.5% from Lucknow, Chhotray et al[14] with 25.92% from few suburban Indian locality and Okyay et al[2] with 31.8%. On the other hand higher rates were observed by Wani et al[9] with 71.5% at Kupwara district of Punjab, Zulkifli et al[15] and Naxsana et al[16].

It was found in the study that 30.1% (28/93) were infected by single helminthic parasite and 22.6% (21/93) were infected by multiple helminth parasites. Similar finding was recorded by Wani et al [9], Lindo et al [17]and Legesse et al.[18]

The results of this study indicate that *A. lumbricoides* was the commonest helminth parasite in both male (42.9% i.e. 18/42) and female (43.1% i.e. 22/51) children, followed by *Trichuris trichiura* 31% (13/42) in male and 27.5% (14/51) in female children. This may be due to the presence of the source of the infection in the area studied and frequent faeco-oral spread of infection among children. In addition, contamination of soil by human faeces (especially for Ascaris and Trichuris) in combination with a high degree of overcrowding and a low-income level increases the susceptibility to helminthiasis. Similar results were shown by Wani et al[9] in Punjab, Al-Nakkas et al. [19] and Lindo et al.[17]

This study shows a significant rate of infection in above two years age group, which corroborates well with many other studies done earlier e.g. Muniz-Junqueira et al [20], Zulkifli et al [15] etc. Factors like late age of weaning, habit of eating soil, playing out of household, etc., may be some explanation. Though stool samples could be collected more from female (than male), there was no significant association with sex of the subject and helminthic infection. This study shows nearly two thirds of the mothers dwelling in informal urban settlement were uneducated /illiterate, a fact having a significant bearing in intestinal helminthiasis. Excreta disposal practices were found to be predominantly (more than two third cases) unhygienic and family sizes were largely big (more than 5). Ulukanligil et al found that more than 90% cases belonged to low socio-economic group and more than 70% of mothers were illiterate.[21] Okyay et al studied related factors of intestinal parasitoses in children of Turkey, and found that 42.6% children with parasite infection had illiterate mother.[2]

All the children included this study had malnutrition of varying degrees. When we tried to take account of use of filtered or boiling water for drinking purpose, situation was very dismal as more than 80% respondents replied negative. Lack of education and awareness could be the reason. This phenomenon was significantly associated with helminthic infection. The data of Zulkifli et al revealed that parasitic infection is significantly lower in children using piped water (60%) compared to other sources (76%). [15] Similar findings was noted by different other authors, e.g., Oberhelman et al; Ulukanligil et al, etc. [22, 21] Though no statistically significant relation between source of drinking water and parasitic infection was found by Okyay et al[2]

Hookworm detection was very less as was the case with *Enterobius vermicularis*. With better sampling (e.g. perianal swab) and collection technique (avoiding delay) detection rate could have been enhanced.

Limitation of the study: Low sample size as well absence of relevant specimen like perianal swabs (for Eneterobius vermicularis, etc.) were two major limitation of the study.

CONCLUSION

This was a preliminary attempt mainly targeting to identify the problems and difficulties faced in carrying out such a study in a more organized and bigger way (e.g. with a larger sample size in a registered or organized slum area). Despite all its limitations and hurdles, the study generated some useful data which can be of help to health officials in policy developments, interventions such as de-worming measures and health education.

Conflict of Interest: None

Ethical Clearance: Obtained

REFERENCE

1. Chan MS. The global burden of intestinal nematode infections - Fifty years on. *Parasitol Today* 1997;13(11):438-443.

2. Okyay P, Ertug S, Gultekin B, Onen O, Beser E. Intestinal parasites prevalence and related factors in school children, a western city sample-Turkey. *BMC Public Health* 2004;4:64.

3. Ostan I, Kilimcioðlu AA, Girginkardeþler N, Ozyurt BC, Limoncu ME, Ok UZ. Health inequities: Lower socio economic conditions and higher incidences of intestinal parasites. BMC Public Health 2007;7:342.

4. Kwitshana ZL, Tsoka JM, Mabaso ML. Intestinal parasitic infections in adult patients in KwaZulu Natal. S Afr Med J 2008;98 Suppl 9:709 11.

5. Alaofe H, Zee J, Dossa R, O'Brien HT. Intestinal parasitic infections in adolescent girls from two boarding schools in southern Benin. Trans R Soc Trop Med Hyg 2008;102:653 61.

6. Uga S, Rai SK, Kimura K, Ganesh R, Kimura D, Wakasugi M, et al. Parasites detected from diarrheal stool samples collected in Nepal. Southeast Asian J Trop Med Public Health 2004;35 Suppl 1:19 23.

7. Mehraj V, Hatcher J, Akhtar S, Rafique G, Beg MA. Prevalence and factors associated with intestinal parasitic infection among children in an urban slum of Karachi. PLoS One 2008;3 Suppl 11:e3680.

8. Awasthi S, Pande VK. Prevalence of malnutrition and intestinal parasites in preschool slum children in Lucknow. *Indian Pediatr* 1997 Jul;34(7):599-605.

9. Wani SA, Ahmed F, Zargar SA, Fomda BA, Ahmed Z, Ahmed P. Helminthic infestation in children of Kupwara district: a prospective study. *Indian J Med Microbiol* 2007;25(4):398-400.

10. Adams VJ, Markus MB, Adams JF, Jordaan E, Curtis B, Dhansay MA, et al. Paradoxical helminthiasis and giardiasis in Cape Town, South Africa: Epidemiology and control. Afr Health Sci 2005;5:276 80.

11. Jonsson U. Malnutrition in South Asia. In: Gillespie S, editor. *Nutrition and Poverty*. Kathmandu: UNICEF; 1997. p. 53-67.

12. World Health Organization. Basic laboratory methods in medical parasitology. Geneva: WHO: 1991.

13. Laboratory methods for diagnosis of parasitic infections. In: Forbes B A, Sahm D F, Weissfeld A S, editors. Bailey & Scott's diagnostic microbiology. 12th ed. Missouri: Mosby Company; 2006. p. 604-708.

14. Chhotray GP, Ranjit MR. Effect of drug treatment on the prevalence of intestinal parasites amongst school children in a sub-urban community. Indian J Med Res 1990 Jul;91:266-9.

15. Zulkifli A, Anuar AK, Atiya AS, Yano A. The prevalence of malnutrition and geo-helminth infections among primary schoolchildren in rural Kelantan. Southeast *Asian J Trop Med Public Health* 2000 Jun;31(2):339-45.

16. Nxasana N, Baba K, Bhat VG, Vasaikar SD. Prevalence of Intestinal Parasites in Primary School Children of Mthatha, Eastern Cape Province, South Africa. *Ann Med Health Scien Res* 2013 Oct;3(4): 511-16.

17. Lindo JF, Validum L, Ager AL, Campa A, Cuadrado RR, Cunning R, et al. Intestinal parasites among young children in the interior of Guyana. West Indian Med J 2002;51:25-7.

18.Lege sse M, Erko B. Prevalence of intestinal parasites among school children in rural areas close to the southeast of Lake Langano. Ethopia J Health Dev 2004;18:116-20.

19. Al-Nakkas EM, Al-Mutar MS, Sheweiki HS, Prem N, Shouky Rihan. Parasitic infection in Kuwait: A study based on primary care centres. Middle East J Fam Med 2004;3:118-24.

20. Muniz-Junqueira M, Queiroz E. Relationship between protein-energy malnutrition, vitamin A, and parasitoses in children living in Brasilia. Rev Soc Bras Med Trop Mar 2002;35(2):133-141.

21. Ulukanligil M, Seyrek A. Demographic and socio-economic factors affecting the physical development, haemoglobin and parasitic infection status of school children in Sanliurfa province, Turkey. *Public Health* 2004 Mar;118(2):151-8.

22. Oberhelman RA, Guerrero ES, Fernandez ML, Silio M, Mercado D, Comiskey N *et al*. Correlation between intestinal parasitosis, physical growth and psychomotor development among infants and children from rural Nicaragua. *Am J Trop Med Hyg* 1998;58(4):470-475.