Original Article

Prevalence of helminthic infestations among Bangladeshi rural children and its trend since mid-seventies

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Abstract

Background and objectives: Helminthic infestation is one of the commonest health problems in a developing country like Bangladesh. The objectives of the current study were to determine the prevalence of helminthic infestations, associated risk factors and its effects among the rural children in Bangladesh. The trend of helminthic infestation rate over time was also analyzed.

Methodology: A cross-sectional study was conducted among the rural primary school children of Sreepur Upazilla of Gazipur District. The area is located about 40 km north-east of capital Dhaka. A total of 593 students aged 5-13 years were enrolled from 5 primary schools. Out of 593 children, 204 agreed to provide fecal samples. A semi-structured questionnaire was used to collect data by face to face interview method and several anthropometric measurements along with clinical examinations were also carried out. Helminth ova were detected by direct microscopy of fecal smear and floatation concentration methods. Data were analyzed using the software IBM SPSS (Version 20).

Result: Out of 204, 80 (39.2%) children were infested with at least one species of helminth. *Ascaris lumbricoides*, *Trichuris trichiura* and mixed infection was 23%, 12.8% and 3.4% respectively. Overall prevalence of infection was higher among female students compared to male students ($p < 0.05$). Living in mud-floor and thatch walled houses were significantly ($p < 0.05$) associated with increased helminthic infestation. The risk behaviors commonly related to helminthic infestation revealed no difference between infected and non- infected groups of children. Height, weight, mid-upper arm circumference (MUAC), skin fold thickness, and waist and hip circumference of worm infested children were not significantly different from those without worm infestation.

Conclusion: The results reflect that the deworming program of Sreepur Upazilla was not fully successful. Poor socio-economic condition and lack of awareness of personal hygiene played an important role in prevalence of parasite infestation.

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Introduction

Helminthic infestation of children is a common public health challenge in developing and resource poor countries [1]. Transmission of intestinal nematodes involves contamination of the environment by helminth eggs due to lack of adequate sanitation, poor personal hygiene and low socio-economic conditions [2]. Occupation may also have an important influence on hookworm epidemiology as higher rates of hookworm infestation are observed among adults [3]. Engagement in agricultural pursuits remains a common denominator for human hookworm infection. Heavy infections in Sichuan Province, China and in Vietnam, for instance, are attributed to widespread use of faeces as night-soil fertilizer [4].

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Globally more than two billion people are infected with soil-transmitted nematodes [5]. An estimated 874.5 million children require regular and periodic deworming in disease-endemic countries [6,7]. Geographically, the maximum numbers of children with intestinal worms live in India, followed by Nigeria, Indonesia and Bangladesh. Chronic morbidities resulting from high-intensity worm infection in children affects physical growth and cognitive development. Helminth-induced chronic malnutrition may result in growth stunting and decreased physical fitness that may resolve after deworming, although the deficits can be permanent in chronic cases [8,9]. Apart from physical growth and fitness, chronic parasitism can lead to decreased school attendance, decreased grade attainment, and reduced cognitive development [8,10,11]. In 2001, the World Health Assembly urged member states to control the morbidity of helminthic infestations through large-scale use of anti-helminthic drugs for school-aged children in developing countries [4]. However, improved sanitation and hygiene are essential for the long-term control of parasitic diseases. The preventive measures for the transmission of helminthic infestation include use of latrine, drinking safe water, not using human feces as fertilizer, improved hand hygiene, washing vegetables before cooking and appropriate covering of foods.

Prior to the initiation of deworming program in Bangladesh in 2005, the prevalence of worm infestation was about 79.8% [12]. The government estimated that 20 million Bangladeshi children were at risk for soil transmitted helminthic infestations (STHI) [12]. At first, Ministry of Health began piloting deworming programs through STH Control Program in schools of three districts in 2005 and later achieved full national coverage by 2008. Deworming is now conducted for all school-age children aged five to twelve years old through all primary level institutions in the country biannually preferably in every May and November. A single dose of albendazole is administered. Out-of-school children are also covered under the deworming program. The intervention aims to achieve the global target of eliminating morbidity due to soil transmitted helminthiases in children by 2020 in Bangladesh [5].

Therefore, the objectives of the current study were to determine the prevalence of helminthic infestations, associated risk factors and effects of worm infestation among school going children in a rural area. The trend of worm infestation rate over time (from mid-70s to 2018) was also analyzed to understand the impact of mass deworming program.

Methodology

The cross-sectional study was carried out in five primary schools from 15th February to 4th March 2018 in Sreepur Upazilla. The rural area is located about 40 km north-east of capital Dhaka. Children aged 5-13 years were enrolled purposively and conveniently from 5 primary schools. Written consent was taken from the Head of the schools and verbal consent was taken from each of the students. A total of 593 respondents were interviewed.

A semi-structured questionnaire was used for data collection. Several anthropometric measurements namely height, weight, waist and hip circumference and mid-upper arm circumference (MUAC) were taken to assess the nutritional status with the aim to find the relationship between infestation rate and nutritional status of children. Each student was given a plastic pot for stool collection. Of the 593 children, 204 agreed to submit their stool for the diagnosis of helminth. Morning stool was collected in a previously labeled collection pot. The pot was tightly closed and sealed and put into a plastic bag. All sample pots were stored in a refrigerator at four degree temperature. It was transported to our microbiology laboratory in a cold box within 24 hours. Microscopic examination of stool was done by preparing slide using normal saline to observe ova of helminthes under 10X and 40X objectives. Stool samples were evaluated using the floatation concentration technique. BMI and waist-hip ratio were calculated from the collected data.

The relationship between infection by intestinal parasites and the variables sex, age group, and neighborhood was assessed using the Chi-squared or the Fisher exact tests. Independent sample t- test was done to assess the difference in nutritional indicators between infected and non-infected groups. Statistical significance was assumed at a p-value <0.05. The statistical analyses were performed using IBM SPSS statistics 20 software. Participants infected with pathogenic intestinal parasites received appropriate treatment later.

An attempt has been made in the current study to find out the trend of infestation of intestinal parasites over the years in Bangladesh and shown in Table 5 of the result chapter.

Result

Out of 204 participants, 80 (39.2%) children were infected with at least one species of helminth (Table 1). Infections by *A. lumbricoides* predominated (23%) followed by *T. trichiura* (12.7%). Mixed infection was observed among 3.4% children. None of them were infected by hookworm.

Table-1: *Rate of intestinal helminth infestation among study children*

Helminthes	Number (%)
Ascaris lumbricoides	47 (23.0)
Trichuris trichiura	26 (12.7)
Mixed	7 (3.4)
Total	80 (39.2)

Table 2 shows that the overall prevalence of worm infestation was higher among female compared to male children ($p < 0.05$). Living in mud-floor and thatch-walled house was significantly associated with being infected by helminthes. Other socio-demographic factors namely parent's education, occupation, type of latrine did not vary among the infected and non-infected children. The students were asked about the behaviors commonly related to helminthic infestation (e.g. hand washing habits). The behaviors of children did not significantly affect the rate of worm infestation (Table-3).

Several anthropometric measurements were taken to see whether nutritional status varied among infected and non-infected children. No significant difference was observed in height, weight, BMI, MUAC, etc between the worm infested and non-infested groups (Table-4).

Table 5 shows the data from several studies regarding the trend of helminthic infestations in rural and urban population of Bangladesh since mid-seventies. The overall rate of soil transmitted helminth infestation has declined overtime.

Table-2: *Rate of intestinal helminth infestation in relation to demographic characteristics of the study population (n=204)*

Variable	Number (%)	Positive for helminth n (%)	p value
Sex			
Male	94 (46.1)	30 (31.9)	< 0.05
Female	110 (53.9)	50 (45.5)	
Fathers' occupation			
Farmer	15 (7.4)	7 (46.7)	
Day labourer	52 (25.5)	22 (42.3)	
Service	88 (43.1)	33 (37.5)	ns
Business	33 (16.2)	13 (39.4)	
Others	16 (7.8)	5 (31.3)	
Fathers' Education			
Illiterate	43 (21.1)	17 (39.5)	ns
Literate	161 (78.9)	63 (39.1)	
Mothers' occupation			
Housewife	116 (56.9)	46 (39.7)	
Service	73 (35.8)	27 (37.0)	ns
Business	11 (5.4)	4 (36.4)	
Others	4 (2)	3 (75.0)	
Mothers' Education			
Illiterate	27 (13.2)	12 (44.4)	ns
Literate	177 (86.8)	68 (38.4)	
Latrine at home			
Shared	49 (24.0)	16 (32.7)	ns
Own	155 (76.0)	64 (41.3)	
Floor of the house			
Thatched/Mud	102 (50.0)	48 (47.1)	< 0.02
Brick	102 (50.0)	32 (31.4)	
Wall of the house			
Thatched	98 (48.0)	47 (48.0)	
Tin	20 (9.8)	7 (35.0)	< 0.05
Brick	86 (42.2)	26 (30.2)	

Note: ns- not significant.

Table-3: *Rate of intestinal helminth infestation in relation to risk behaviors among the children (n=204)*

Parameters	Number (%)	Positive for helminth N (%)	p value
History of taking anti-helminthes			
No	36 (17.6)	15 (41.7)	
Yes	166 (81.4)	65 (39.2)	ns
Don't know	2 (1.0)	0 (0.0)	
Habits of washing fruits / vegetables before eating			
No	22 (10.8)	5 (22.7)	ns
Yes	182 (89.2)	75 (41.2)	
Habits of biting nails or licking fingers			
No	179 (87.7)	72 (40.2)	ns
Yes	25 (12.3)	8 (32.0)	
Habits of walking barefoot			
No	122 (59.8)	49 (40.2)	ns
Yes	82 (40.2)	31 (37.8)	
Habits of hand washing before eating			
No wash	1 (0.5)	1 (100.0)	
Water only	94 (46.1)	33 (35.1)	ns
With soap	109 (53.4)	46 (42.2)	
Hand wash after toilet			
No wash	3 (1.5)	2 (66.7)	
Water only	37 (18.1)	15 (40.5)	ns
With soap	164 (80.4)	63 (38.4)	
Fingernail dirty			
Yes	103 (50.5)	41 (39.8)	ns
No	101 (49.5)	39 (38.6)	

Note: ns- not significant.

Table-4: *Anthropometric parameters of children with and without worm infestation*

Parameters	Total Mean ± SD	Helminth infestation		p
		Positive Mean ± SD	Negative Mean ± SD	
Age (years)	8.63 ± 1.95	8.73 ± 1.76	8.57 ± 2.07	ns
Height (cm)	126.33 ± 11.30	125.96 ± 11.32	126.57 ± 11.32	ns
Weight (kg)	23.46 ± 6.93	22.99 ± 6.29	23.76 ± 7.33	ns
MUAC (cm)	17.55 ± 2.47	17.40 ± 2.17	17.65 ± 2.65	ns
Skin fold thickness (mm)	10.66 ± 4.62	9.88 ± 4.26	11.16 ± 4.79	ns
Waist circumference (cm)	52.63 ± 5.99	52.43 ± 5.35	52.76 ± 6.39	ns
Hip circumference (cm)	63.76 ± 7.03	63.44 ± 6.31	63.97 ± 7.48	ns

Note: ns- not significant.

Table-5: *Trend of helminthic infestations in Bangladesh overtime among different population*

Place	Year	Infestation rates (%)					References
		A. lumbricoides	*T. trichiuria*	*A. duodenale*	Mixed	Total	
Rural	1976	92.9	52.46	9.91	-	99.03	[15]
	2005	-	-	-	-	71.01	[21]
	2008	-	-	-	-	90.9	[22]
Urban slum	1997	20.39	15.23	-	15.25	-	[18]
	2005	34.38	17.39	-	12.65	-	[20]
	2016					83.3	[23]
Urban	1979	23.1	10.0	6.2	10.5	-	[16]
	1999	20.39	15.3	-	11.57	-	[19]
Rural	2018	23	12.8	0	3.4	39.2	**Present study**

Discussion

Geographically the maximum number of infected individuals with overall helminthic infestation lives in South Asia (ie, Indian subcontinent), Southeast Asia, and East Asia, followed by sub-Saharan Africa and Latin America [2]. In terms of specific countries, the greatest numbers of children with intestinal worms lived in India, followed by Nigeria, Indonesia, and Bangladesh [7]. Bangladesh was seen to have all the requisite conditions for a high helminthic infestation. In this context, the current study was conducted to measure effects of various risk factors (like use of sanitary latrines, hand washing, walking barefoot, etc) on prevalence of helminthic diseases.

The current study revealed that overall prevalence of helminthic infestation was 39.2%. Several international cross-sectional surveys reflected similar prevalence of overall helminthic infestation in comparison to the current study. For instance, in primary school children in a rural community in Imo State, Nigeria the overall prevalence of helminthic infestation was reported as 30.3% [1]. Similar rates of prevalence were reported in recent studies in different countries of Africa (Nigeria 28.9%), Middle East (Iran 25.1%), Asia (Tajikistan 32%, Nepal 23.7%) and Eurasia (Turkey 44.6%) [24-28]. Significantly lower (12.6%) prevalence rate was observed in Thailand, where as higher rates were reported in two different cities of India (63.9%) and Pakistan (66%) and also in Ethiopia (54.5%) [29-32].

Prevalence of *A. lumbricoides* (23.00%) and *T. trichiura* (12.8%) found in the present study was similar to the findings of various studies carried out in Bangladesh from 1976 till present [13-23]. In contrast, mixed infection (both *A. lumbricoides* and *T. trichiura*) was much lower (3.4%) in the present study compared to the rates reported in studies conducted previously in Bangladesh [13-23].

High rates of infestation of intestinal parasites have been observed throughout Bangladesh in several studies during the last five decades. Kuntz's (1960) study showed a high infestation rate of intestinal parasites especially *A. lumbricoides* which was the first ever reported survey in Bangladesh [13]. Later in 1968, Muazzem & Ali found 25.6% of *A. lumbricoides* infestation in urban school children [14]. Muttalib reported prevalence rate of 92.9% and 52.46% of *A. lumbricoides* and *T. trichiuria* in 1976 in rural children and in 1979 Chowdhury reported the prevalence as 23.1% and 10.0% in urban children [15,16]. The overall prevalence as reported by Muttalib was as high as 99.03% among 1-15 years aged rural children in 1976 but on the other hand Huq & Sheikh reported 65.8% parasitic infestation in another study in the same year [15,17]. Khanum et al. did the prevalence study in 1997, 1999 and 2005, all of which showed significant improvement from 1976, but within the nine year period (1997-2005) there was no improvement, rather deterioration was observed in both *A. lumbricoides* and *T. trichiura* prevalence rates [18-20]. In 2005, Uddin et al also found

surprisingly high infestation rate (71.01%) among rural adolescent girls and this trend continued till 2016 as shown in Table-5 [21-23]. However, the current study have found considerable decline in the prevalence of worm infestation among rural children.

The high prevalence of worm infestation observed in the present study could be related to poor living standards and low socio-economic condition of the families of infected children in Sreepur Upazilla. The low socio-economic condition was reflected by their mud-floor and thatch-walled households. Surprisingly one-fifth of the participants reported not to use soap after defecation. The inadequacy in personal hygiene of the children was also found in this study; nearly half of the children had dirty finger nails. These issues need to be addressed in future programs. Moreover, this high prevalence could be an indicator of the failure of ongoing national deworming program. The nutritional status did not differ in two groups. This could be due to low infection loads of helminthes.

Conclusion

The higher prevalence of helminthic infestation implies that further emphasis should be given on the deworming program as well as regular health education campaigns in schools of rural areas.

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Contribution of authors

SA and SD[1]: involved in study design, data analysis and manuscript writing; SD[2] did the microbiological work; MMR: supervised field work and data collection; MM: responsible for overall supervision.

SA and SD[1] contributed equally to this study.

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