ORIGINAL ARTICLE

Intestinal Parasitic Infestation in School Going Children of Rishikesh, Uttarakhand, India

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Abstract

Background: Intestinal parasitism(IP) remains a common problem in school going children. **Aims & Objectives**: To study the prevalence IP infestation in school going children and to study the relation with type of water supply and sanitation. **Material and Methods**: A cross sectional study was carried out and a total of 461 stool samples were collected from children under ten years of age from various schools of Rishikesh. The normal saline and iodine mounts of fresh and saturated salt solution concentrated samples were examined. Modified Ziehl Neelsen staining was done for detection of coccidian parasites. The statistical significance within gender, age, drinking water supply, sanitation and other socio-demographic parameters was assessed by Chi-square test. **Results:** 112 (24.3%) out of 461 were positive for intestinal parasites. *Giardia lamblia* was the commonest parasite (15.2%) followed by *Hymenolepis nana* (2.38%), Hookworm (2.17%), *Enterobius vermicularis* (2.17%), *Entamoeba histolytica* (2.17%), *Ascaris lumbricoides* (0.86%), and *Cryptosporidium parvum* (0.86%). **Conclusions:** Due to lack of proper sanitation & education along with low socioeconomic background, IP infections are still prevalent among school children. Regular awareness program on promoting good health, maintenance of proper personal hygiene and carrying out regular deworming in schools should be instituted for control.

Keywords

Intestinal parasitism; Children; Rishikesh

Introduction

According to WHO Intestinal parasitic infections is a major public health problem, particularly in the developing countries like India. Billions of people are affected globally, majority being children. Around 600 million school-age children live in areas where these parasites are endemic. (1,2)

Worm infestation is one of the major causes of childhood malnutrition, anaemia, stunted physical and poor cognitive performance. As per WHO recommendations, in areas where prevalence of mild to moderate underweight children is greater than 25% and where parasites are known to be wide spread, high priority should be given to deworming programme. Thus national, regional and local data

on prevalence of Intestinal parasitism and efficacy of anti-helminthic drug trials are crucial. (3,4)

Estimation of the global burden of morbidity and mortality related to parasitic infections is an important prerequisite for developing preventive strategies. The prevalence rates of intestinal parasitism found in studies conducted in various parts of India in this century range widely from 7.8% to 91% (5-13). Most of these studies report *Giardia lamblia* and *Ascaris lumbricoides* to be the most commonly prevalent intestinal parasitism (IPs). in different age groups

Since there is no published data available regarding the prevalence of IPs from Rishikesh the present study was a pilot project to estimate this burden of parasitic infestation in the under ten paediatric school going population of Rishikesh and to study its relation with type of water supply and sanitation.

Aims & Objectives

- To study the prevalence of intestinal parasitic infestation in school going children less than ten years of age
- To study the relation of type of water supply and sanitation with intestinal parasitic infestation

Material & Methods

Study type: A cross-sectional study

Study population: It was conducted on 461 school going children less than ten years of age.

Study area: Children were recruited from four schools of Rishikesh.

Sample size determination

The target students were selected based on their educational level (from class 1 to class 5) and age less then 10 years.

The sample size was determined by statistical formula n = Z2xP (1-P)/d2 where P (prevalence of intestinal parasite in the area), d (at 5% marginal error) and standard score (Z) at 95% confidence interval. The prevalence of intestinal parasitic infection in Uttarakhand was reported as 11.2% (14). The minimum sample size determined for the study was 152.

Inclusion Criteria: School going children less than 10 years of age.

Ethical consideration: Study was conducted after obtaining approval by Institute Ethics Committee, written informed consent was taken from the heads of institution.

Sample collection and processing: Structured questionnaire to gather relevant information pertaining to predisposing factors like socio-demographic characters, mother and child characteristics with past medical history, past history of anti-helminthic/anti-parasitic treatment, type of toilet (open air defecation or sanitary latrine) and type of water supply was given to the guardians/parents to be collected next day along with the stool sample.

About 2 gms of stool specimens were collected in a well labelled wide mouthed sterile plastic container and transported within two hours to the laboratory and subjected to macroscopic and microscopic examination. Direct examination followed by concentration with saturated salt solution was done by saline mounts, iodine staining and modified Ziehl Neelsen staining. Additionally, subjects with specific symptoms (i.e. anal pruritus) were subjected to scotch tape test of under the nail scrapings to detect eggs of *Enterobius vermicularis* (As anal scotch tape test was not considered appropriate in the school settings).

All developmental stages of parasite (cyst, egg, larvae, adult worm and worm segment) were recorded.

Data analysis: The collected data were checked for completeness and analysed using Statistical Package for Social Sciences (SPSS) (20.0 version). Chi square was used to determine association. Values were considered to be statistically significant when values were less than 0.05.

Results:

Of the 461 school going children screened, male to female ratio was 1.15:1. Mean age of the children was 7.26 ± 1.57. Out of 461 stool samples collected 112(24.3%) were positive for various IPs. 96 samples were positive before concentration and 16 samples were positive after concentration with saturated salt solution. The majority (70; 15.2%) were the cyst of *Giardia lamblia* followed by eggs of Hymenolepis nana (2.38%), Hookworm (2.17%), *Enterobius vermicularis* (2.17%), *Entamoeba histolytica* (2.17%), *Ascaris lumbricoides* (0.86%), and Cryptosporidium parvum (0.86%) (Table 1). There was no significant difference in prevalence rate of IPs between males and females, except H. nana and hookworm, which were slightly higher in males and E. vermicularis and E. histolytica which were higher in females (Table 2). Age wise prevalence was higher (26.43%) in less than/ equal to 7 years age group. Prevalence of G. lamblia, E. histolytica and E. vermicularis was higher in children upto 7 years age (Table 3) 4 out of 23 nail

scrapings taken from children with anal pruritus showed eggs of E. vermicularis while rest of the 6 eggs were detected only in the stool samples.

Overall prevalence was higher (27.2%) in population not having municipal water supply in their house. While G. lamblia, C. parvum and A. lumbricoides were found higher in population having municipal water supply; H. nana, hookworm, E. vermicularis and E. histolytica were more common in population not having municipal water supply. However, these differences were not found to be statistically significant. (Table 4)

Prevalence was much higher in population defecating openly (80%) as compared to population having toilet in house (21.1%) and this difference was statistically significant. Except Cryptosporidium, all other parasites were common in population defecating in open. (Table 5) Factors like sanitation levels, parents education, family annual income were significantly associated with prevalence of intestinal parasitic infections (Table 6). None of the respondents could specify any history of having any anti-helminthic treatment.

Discussion

The prevalence of IPs depends upon various socio – economic factor like, hygiene, availability of clean drinking water, poverty etc. In our study the prevalence of IPs (24.3%) was comparable to other North Indian studies conducted in Bareilly (22.81%) (8). Katulla *et al* (5) reported 7.8% prevalence of soil transmitted helminthic infections in Vellore and Thiruvanamalai districts, and Fernandez *et al* (13) reported a very high prevalence (91%) of IPs in school going children in a rural setting in and around Chennai.

These studies have reported a predominance of helminthic infestation especially of *A.lumbricoides*, however in the current study the most common parasitic infection was *G.lamblia* followed by *H. nana*. This is in line with other studies which reported cyst of Giardia as the commonest Intestinal parasite among school children (7,10,11). In concordance with our study, Mane and co-workers reported *G.lamblia* as the commonest IP and *H.nana* as the commonest helminthic infestation (9).

No significant difference in prevalence rate was found on the basis of gender. Sha *et al* from Nepal and Ngui *et al* from Malaysia also reported the same (15,16). Some studies have shown a male preponderance. (17)

Most frequent age group associated with parasitic infections in this study was three to seven years, which could be due to increased outdoor activities (playing), inadequate self-toilet care in this age group as compared to younger children (less than three years) who are restricted inside the house and dependent on others for their toilet care. In older children prevalence rates tend to come down.

In this study, most of the children involved in defecation in the open were infected by one or more IP. Open defecation in the fields makes the stools exposed to the scavenging activities of animals and drying effects of the sun and wind dispersal makes soil a major reservoir and source of IPs both directly and indirectly.

No significant difference of prevalence of IPs was seen among children who used untreated water for drinking than those who used municipality water. This may be due to contamination of even the municipal water supplies with human/animal waste, leaking sewage lines, inadequate levels of chlorine and unhygienic storage of water.

Similar to a study from Andhra Pradesh (12) we encountered a high prevalence of intestinal protozoan parasitic infection as compared to helminthic infections. Both Giardia and Entamoeba can be transmitted faeco-orally by drinking infected water and large outbreaks have resulted from the contamination of municipal water supplies with human/animal waste (18). In India, quality of drinking water and the limited availability of water used for hygiene is associated with increased prevalence of such IPs. The problem is greater in the rural areas that do not have proper municipal water network or sewage system.

Parasite positivity also depends upon the endemicity of a particular parasitic infection in the given geographical area e.g *A.lumbricoides* infestation is more common in areas with clayey soil .At Rishikesh the soil is sandy to gravel and a higher prevalence of Giardia, hookworm and *H.nana* has been found in adults of Garhwal hills of Uttarakhand by some workers. (14)

Cryptosporidium was detected in some (4/461) of the children indicating need for further screening of children and detecting *cryptospordium* because these children require immediate attention due to associated morbidity.

It was seen that low maternal education levels was associated with IPs (p=0.04). This may be due to lack of awareness regarding health and hygiene habits

among less educated mothers (17,19). The same was noted by us in relation to father's educational levels too.

It can be hypothesized that these differences in prevalence might be associated with low socio-economic status of their families. This phenomenon of clustering of infections hamper attempts in controlling these parasitic infections, because children with heavy IP burden are likely to keep reintroducing them into the community repeatedly.

Due to single stool examination for detection of intestinal protozoan infections, we may have underestimated the prevalence, since optimal laboratory diagnosis of IP infections requires the examination of at least three stool specimens. Further details of epidemiological parameters should have been obtained to have an accurate understanding and cause of the parasitic burden of this area.

Conclusion

Due to lack of proper sanitation & education along with low socioeconomic background IP infections are still prevalent among school children and remains as a common health problem. Regular awareness program on promoting good health, maintenance of proper personal hygiene and carrying out regular deworming in schools should be instituted.

Recommendation

Intestinal parasitism remains a common problem in school going children. Lack of personal hygiene, sanitation and safe drinking water remain the major causes of IP. Hence, creating awareness, ban on open defecation and provision of safe drinking water should be the mandate of any ruling government.

Limitation of the study

We may have underestimated the true prevalence of IP because laboratory diagnosis of IP infections requires the examination of at least three stool specimens whereas we could only conduct a single stool screening. Further details of epidemiological parameters should have been obtained to have an accurate understanding and cause of the parasitic burden of this area.

Relevance of the study

Since there is no published data available regarding the prevalence of intestinal parasitism from Rishikesh the present study is a pilot project to estimate the prevalence of parasitic infestation in the under ten paediatric population of Rishikesh and to study its relation with type of water supply and sanitation.

Authors Contribution

DB, PG, GS: contributed in every step of the study, MB and HS helped in mainly in data acquisition and data analysis, manuscript reviewing, editing.

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Tables

TABLE 1 PARASITIC DISTRIBUTION IN STOOL SAMPLES (N= 461)

Name of the parasite	No. of positive samples (%) (n=112)
Protozoans	
Giardia lamblia	66 (14.31%)
Entamoeba histolytica	10 (2.17%)
***Cryptosporidium* spp.**	4 (0.86%)
Helminthes	
Hymenolepis nana	7 (1.51%)
Hookworm	7 (1.51%)
Enterobius vermicularis	9 (1.95%)
Ascaris lumbricoides	3 (0.65%)
Giardia lamblia* and *Hymenolepis nana	2 (0.43%)
***Giardia lamblia* and hookworm**	1 (0.22%)
Giardia lamblia* and *Enterobius vermicularis	1 (0.22%)
***Hymenolepis nana* and hookworm**	1 (0.22%)
Hymenolepis nana*, hookworm & *Ascaris lumbricoides	1 (0.22%)
Total	112

TABLE 2 GENDER WISE PARASITE POSITIVITY(%) (N=119)

	MALE (n= 247)	FEMALE (n= 214)
Giardia lamblia	36 (14.57%)	34 (15.88%)
Hymenolepis nana	8 (3.23%)	3 (1.4%)
Hookworm	8 (3.23%)	2 (0.93%)
Entamoeba histolytica	4 (1.6%)	6 (2.8%)
Enterobius vermicularis	2 (0.8%)	8 (3.73%)
***Cryptosporidium* spp.**	3 (1.21%)	1 (0.46%)
Ascaris lumbricoides	1 (0.4%)	3 (1.4%)

TABLE 3 AGE WISE PARASITE POSITIVITY (%) (N=119)

Name of the parasite	Age less than/equal to 7 (n=261)	Age more than 7 (n=200)
Giardia lamblia	42	28
Hymenolepis nana	7	4
Hookworm	7	3
Entamoeba histolytica	7	3
Enterobius vermicularis	7	3
Cryptosporidium	2	2
Ascaris lumbricoides	3	1

TABLE 4 PREVALENCE OF INTESTINAL PARASITES IN RELATION TO DRINKING WATER SOURCE. (N=119)

Name of the parasite	Municipal Supply (n= 336)	Others (n= 125)
Giardia lamblia	54	16
Hymenolepis nana	6	5
Hookworm	6	4
Entamoeba histolytica	4	0
Enterobius vermicularis	6	4
Cryptosporidium spp.	4	0
Ascaris lumbricoides	3	7

TABLE 5 PARASITE POSITIVITY IN RELATION TO SANITATION (%) (N=119)

Name of the parasite	Toilet in house (n= 436)	Open defecation (n=25)
Giardia lamblia	66 (15.13%)	4 (16%)
Hymenolepis nana	7 (1.6%)	4 (16%)
Hookworm	7 (1.6%)	3 (12%)
Entamoeba histolytica	1 (0.23%)	3 (12%)
Enterobius vermicularis	6 (1.37%)	4 (16%)
Cryptosporidiumspp.	4 (0.9%)	0 (0%)
Ascaris lumbricoides	6 (1.37%)	4 (16%)

TABLE 6 COMPARATIVE ANALYSIS OF VARIOUS PARAMETERS VS PARASITE POSITIVITY (%) (N=112)

Parameter	Number positive (%)	p value
Gender		
Male (n=247)	57 (23.07%)	0.5
Female (n=214)	55 (25.7%)	
Age		
Less than/equal to 7 (n=261)	69 (26.43%)	
More than 7 (n=200)	43 (21.5%)	0.22
Water supply		0.37
Municipal supply (n=336)	78 (23.2%)	
No municipal supply (n=125)	34 (27.2%)	
Sanitation		<0.0001
Toilet at home (n=436)	92 (21.1%)	
Open defecation (n=25)	20 (80%)	
Rooms in the house	83 (25.07%)	NS
Less than/equal to 2(n=331)	29 (22.3%)	
More than 2(n=130)		
Number of family members		NS
Less than/equal to 4(n=221)	52 (23.53%)	
More than 4(n=240)	60 (25%)	
Father education		0.003
Below primary education (n=200)	62 (31%)	
Above primary education(n=261)	50 (19.15%)	
Mother education		0.04
Below primary education (n=231)	63 (27.27%)	
Above primary education (n=230)	49 (21.3%)	
Annual family income		0.012
Less than/equal to 50000 (n=216)	64 (29.63%)	
More than 50000 (n=245)	48 (19.6%)	