INTESTINAL PARASITES IN CHILDREN WITH DIARRHEA IN DELHI, INDIA

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Abstract. The parasitic causes of diarrhea in children in Delhi were determined by the direct smear technique; stool specimens of 127 children were examined for intestinal parasites. In 59 cases (46.5%) intestinal helminths and protozoa were demonstrated. *Ascaris lumbricoides* was observed in 1 (0.8%) case, while *Trichuris trichiura* was the finding in 3 (2.4%). Protozoal parasites included *Giardia intestinalis* and *Entamoeba histolytica* in 14 (11%) cases each, *Balantidium coli* in 3 (2.4%) cases and *Cryptosporidium* spp in 24 (18.9%) patients. Mixed infection was not seen in any of the cases. Intestinal parasites may increase susceptibility to infection with other intestinal pathogens and therefore with the help of a simple technique, like direct fecal smear examination, rapid diagnosis can be made and specific therapy instituted.

INTRODUCTION

Intestinal parasitic infections have always been an important public health problem in the tropics, particularly in developing countries like India, where the humid climate, the insanitary environment, and poor socioeconomic conditions contribute to the problem. Chronic infections impair physical and mental growth and development of children in general. Furthermore intestinal parasites may increase susceptibility to infections with other intestinal pathogens. It is therefore important to identify the problem and tackle it in the interest of public health.

Ideally, large-scale studies should be performed repeatedly in order to observe the prevalence and changes in the epidemiology of parasites. However, cost is often a limiting factor. Keeping in mind the paucity of information available on the distribution of parasites in most areas and the increase in their prevalence, the present study was undertaken to ascertain the same among children in Delhi.

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MATERIALS AND METHODS

The study was part of the routine diagnostic work carried out in Lok Nayak Hospital from April 1999 to September 2000. One hundred and twenty-seven children aged 14 years and younger attending the Pediatrics OPD with complaints of acute diarrhea were included in the study. A single stool sample was collected from each patient before the institution of treatment. Stool samples were inspected for the presence of parasitic forms. Saline and iodine wet mount preparations were made and examined before and after concentration of the sample by the formol ether technique.

Modified acid-fast staining of the smears was done; these smears were screened for *Cryptosporidium*, *Isospora*, *Cyclospora* etc. The parasites were identified using standard methodology.

RESULTS

Of the 127 stool samples examined, intestinal helminths or protozoa were found in

Table 1
Prevalence of intestinal parasites.

Parasite	No. (N=127)	%
Ascaris lumbricoides	1	0.8
Trichuris trichiura	3	2.4
Giardia intestinalis	14	11
Entamoeba histolytica	14	11
Balantidium coli	3	2.4
Cryptosporidium spp	24	18.9

Table 2
The distribution of the parasites in the positive samples.

Parasite	No. (N=59)	%
Ascaris lumbricoides	1	1.7%
Trichuris trichiura	3	5.1%
Giardia intestinalis	14	23.4%
Entamoeba histolytica	14	23.7%
Balantidium coli	3	5.1%
Cryptosporidium spp	24	40.7%

59 (46.5%) cases. *Ascaris lumbricoides* was observed in 1 case (0.8%), while *Trichuris trichiura* was the finding in 3 (2.4%) others. Protozoal parasites included *Giardia intestinalis* and *Entamoeba histolytica* in 14 (11%) cases each, *Balantidium coli* in 3 (2.4%) cases and *Cryptosporidium* spp in 24 (18.9%) patients (Table 1). Mixed infection was not observed.

The highest number of cases was seen in the 1-5 years age group (Fig 1). The parasites were equally prevalent in both males and females. No protozoa or helminth eggs were detected in stools of children of less than 1 year of age.

Table 2 shows the distribution of parasites in the positive samples. *Ascaris lumbricoides* and *Trichuris trichiura* were seen in 1.7% and 5.1% respectively, while *Giardia intestinalis* and *Entamoeba histolytica* were each observed

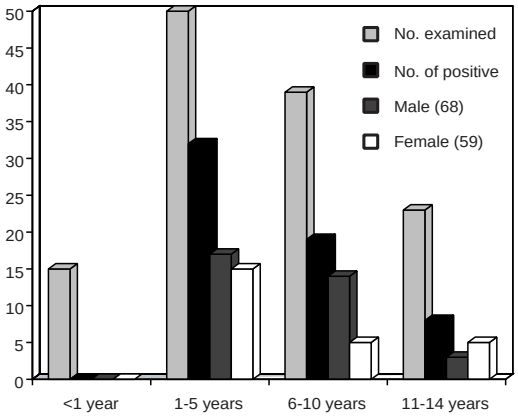

Fig 1–Age and sex distribution of the parasitic infections.

in 23.7%. *Balantidium coli* and *Cryptosporidium* were found in 5.1% and 40.7% of the positive samples.

DISCUSSION

Morbidity due to intestinal parasites has always been an important public health problem in the tropics, but the incidence and severity may vary depending on the location and period of time (Sethi *et al*, 1999); moreover, supposed differences in the rate of prevalence may be due to the use of different diagnostic methods and the difficulties involved in the identification of certain parasites.

In the present study, intestinal parasites were detected in 46.5% of all the stool samples examined. Other Indian studies have reported prevalence ranging from 7.5-15.5% in Chandigarh (Sethi *et al*, 2000) and 16.8% in Delhi (Abraham *et al*, 1969), 47.1% in Andhra Pradesh (Das *et al*, 1981a), 73.4% in Tamil Nadu (Ganga and Ravichandran, 1995), 70.8% and 60% in Gujarat (Das *et al*, 1981b). The study by Abraham *et al* (1969) was carried out in the same institution featured in the present study: comparison serves to highlight the dramatic increase in the prevalence of intestinal parasites over the past thirty years.

An interesting and unexpected finding in the present study was that a relatively high prevalence of *Cryptosporidium* was observed. This protozoan is now recognized as an important cause of diarrhea in both immunocompetent and immunosuppressed patients (Guerrant, 1997). Prevalence rates vary from as low as 1% in North America and Europe to as high as 30% in the Tropics and Subtropics. Workers from developing countries like India have reported the prevalence rates to be 4.3 to 13% (Nath *et al*, 1999). While a study carried out in Switzerland found it to be the most common parasitic cause of diarrhea in children (Essers *et al*, 2000), another one from Varanasi, India, reported it to be the third most common parasitic cause of diarrhea (Nath *et al*, 1999). In the present study we found *Cryptosporidium* in 18.9% of the stool samples examined. Few studies have reported such a high prevalence of this parasite.

An immunodeficient state, age, malnutrition, contact with animals and crowded living conditions have been reported as possible risk factors. However, Sethi *et al* (1999) reported that out of 5 children in their study whose stool samples were positive for *Cryptosporidium*, only one child was HIV positive. Most of the children included in the present study came from families of low socioeconomic status, living in urban slums. The HIV status of the children with stool samples positive for *Cryptosporidium* was not known, all of them being OPD patients; malnutrition and other immunodeficiency states could not be ascertained.

There are three major presentations of cryptosporidiosis in immunocompetent individuals: asymptomatic carriage: acute diarrhea, which is usually watery; persistent diarrhea, which may continue for several weeks (Farthing, 2000). Various case control studies have been carried out to assess the importance of *Cryptosporidium* in acute diarrhea: it has been found that oocysts of the parasite and present in both symptomatic patients and asymptomatic controls (Mantan *et al*, 1985; Katsumata *et al*, 1998; Newman *et al*, 1999) although it is more frequently isolated from the former group. Mantovani *et al* (1995) found asymptomatic carriage in 12.5% of the children included in their study. In the present study *Cryptosporidium* was not found in any child of less than one year of age; most cases were clustered in the 1-5 year age group. Infants and young children are particularly susceptible to infection although breast-feeding may offer protection to infants (Farthing, 2000).

Cryptosporidium has seldom been found to be the sole pathogen in diarrheal stool. Newman *et al* (1999) found enteroaggregative, enterotoxigenic and diffusely adherent *E. coli*, *Giardia lamblia* and helminths to be the commonest co-pathogens with *Cryptosporidium.* In the present study no other parasitic pathogen was found in the stool samples positive for *Cryptosporidium*. However since bacterial and viral pathogens were not sought, they cannot be ruled out. It is possible that in some of the cases in the present study, *Cryptosporidium* may not have been responsible for the diarrhea and was discovered because all the samples were subjected to modified acid-fast staining.

Cryptosporidiosis is more commonly seen during the warm rainy season, which probably reflects increased oocyst contamination of surface and domestic water supplies (Farthing, 2000). Most cases in the present study were also found clustered in the months of July, August and September, which are the hot and humid months in Delhi. The study period (April to October), which includes the peak rainy season in Delhi, and the complete screening of all the samples by modified acid-fast staining, may in part account for the high prevalence of *Cryptosporidium* in this study. It is likely that *Cryptosporidium* is under-diagnosed because clinicians often fail to consider the diagnosis in patients with diarrheal disease (particularly immunocompetent adults and children). As a result clinicians do not request stool analysis for *Cryptosporidium*, a test not normally included in routine stool analysis (Clark, 1999).

Giardia intestinalis and *Entamoeba histolytica* were each detected in 11% of cases. The prevalence of *Entamoeba histolytica* ranges

from 4 to 47% in India (Ebrahim, 1990). The prevalence found in the present study is comparable to the 12.8-13.9% seen in Nepal (Estevez *et al*, 1983; Reddy *et al*, 1998), the 9% in Andhra Pradesh (Das *et al*, 1981a) and the 12.3% in Okhla town, Gujarat (Das *et al*, 1981b), but lower than the 15.2% and 24.4% observed in Tamil Nadu (Ganga *et al*, 1995) and the Sudan (Magambo *et al*, 1998) respectively. Studies from Chandigarh, Saudi Arabia and Bangkok have found the prevalence to be quite low, ranging from 1-6.8% (Sethi *et al*, 2000; Al-Eissa *et al*, 1995, Chavalittamrong and Jirapinyo, 1984).

Workers from Nepal (Reddy *et al*, 1998) and Turkey (Ozelik *et al*, 1995) reported a prevalence of *Giardia intestinalis* of 18.5% and 25% respectively. However Chandigarh, Sudan, Saudi Arabia and Gujarat appear to have prevalence of 4-11.3%, similar to that seen in Delhi (Das *et al*, 1981b; Al-Eissa *et al*, 1995; Magambo *et al*, 1998; Sethi *et al*, 2000).

Balantidium coli appears to have been detected in very few studies. A study from Bangkok reported a prevalence of 1.4%, which is lower than the prevalence (2.4%) seen in the present study (Chavalittamrong and Jirapinyo, 1984).

Of the helminths, only *Ascaris lumbricoides* and *Trichuris trichiura* were detected in the present study. *Ascaris lumbricoides* was seen in 0.8% of cases, which is comparable to the 0.2-0.6% reported from Chandigarh (Sethi *et al*, 2000) and Saudi Arabia (Al-Eissa *et al*, 1995), but much lower than the prevalences of 3-22.6% and 2.7-52.8% that have been reported from other states of India and other part of the world respectively (Das *et al*, 1981a,b; Estevez *et al*, 1983; Chavalittamrong and Jirapinyo, 1984; Ganga and Ravichandran, 1995; Ozelik *et al*, 1995; Reddy *et al*, 1998). The prevalence of *Trichuris trichiura* was 2.4%, which is higher than that seen in other parts of India (1.6-1.8%), Saudi Arabia (0.1%) and Bangkok (0.7%) (Das *et al*, 1981a,b; Chavalittamrong and Jirapinyo, 1984; Al-Eissa *et al*, 1995) but is much lower than that reported from Turkey (5.1%) and Nepal (5.2-5.5%) (Estevez *et al* 1983; Ozelik *et al*, 1995; Reddy *et al*, 1998).

The present study indicates that parasites are an important and common cause of diarrhea, especially in children. Though usually not life threatening, chronic parasitic infestation can impair physical and mental growth and the nutrition and general development of children. Furthermore these intestinal parasites may increase susceptibility to infection with other pathogens.

It is recommended that routine analysis of stool samples in diagnostic laboratories should include elaborate parasitological investigation, with screening for *Cryptosporidium* being an important component. Screening for *Cryptosporidium* can be done using simple and inexpensive technique like modified acid-fast staining.

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