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Prevalence of intestinal parasitic infection among children from a shanty town in Tucuman, Argentina

Dib, J.R.[1,2*], Fernández-Zenoff, M.V.[1,2], Oquilla, J.[1], Lazarte, S.[1] and González, S.N.[1,3]
[1]Facultad de Bioquímica, Química y Farmacia, Universidad Nacional de Tucumán,
San Lorenzo 456, (4000) Tucumán, Argentina
[2]PROIMI-CONICET, Av. Belgrano y Pje. Caseros, (4000) Tucumán, Argentina
[3]CERELA-CONICET, Chacabuco 145, (4000) Tucumán, Argentina
[*]Corresponding author email: jdib@fbqf.unt.edu.ar
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Abstract. A parasitological survey was conducted in children living in a poor area next to a drainage channel, in Tucumán province, Argentina. Stool specimens from 115 children were collected and samples were analyzed by direct microscopy examination and concentration techniques. The prevalence rate of intestinal parasites infection was high (78.3%) and *Blastocystis hominis* was the most frequent protozoan parasite found (68.9%) followed by *Giardia intestinalis* (33.3%), *Entamoeba coli* (24.4%), *Endolimax nana* (12.2%), *Chilomastix mesnili* (5.6%) and *Iodamoeba bütschlii* (2.2%). *Ascaris lumbricoides* was the most prevalent intestinal helminth, with an infection frequency of 38.9%, followed by *Trichuris trichiura* (13.3%), *Strongyloides stercoralis* (13.3%), *Hymenolepis nana* (7.8%) and *Enterobius vermicularis* (3.3%). Multiple parasitic infections were also high, affecting 71.1% of infected population. These results indicate that sanitary policies, including health care and sanitary education have been inadequate for the control of intestinal parasitism in this high-risk population. Implementation of sanitation programs is a basic need and a joint collaboration between public servant and health professionals should be a priority.

INTRODUCTION

The relationship between poverty, deficiencies in hygiene and parasitic infections is a well-known phenomenon (Blumenthal & Schultz, 1976; Gupta, 1990). Parasites play an important role as contributory factors in the etiology of childhood malnutrition especially in undernourished children from socio-economically disadvantaged communities. Despite its importance, there is still inadequate information on the epidemiology of protozoa and helminthes affecting the population. In Tucumán province, located in the north of Argentina, an increase in the number of undernourished children was reported in 2002 (Zeballos, 2003) and this situation motivated us to evaluate the prevalence of intestinal parasites in a peripheral area of Tucumán city.

The study population included 115 children and teenagers aged between 0 and 16 years old and the area of study was located on the outskirts of San Miguel de Tucumán, in the North Channel, tributary to Salí River. The target population is considered under high sanitary risk due to the poor socioeconomic status, inadequate water supply, and contact with the drainage channel which is a direct source of parasitic infections.

The aim of this study was to determinate the prevalence, species, age and gender distribution of intestinal parasitism in children from a settlement next to an irrigation channel in Tucumán province, Argentina.

MATERIALS AND METHODS

During November and December of 2011, 50 mL plastic and hermetic containers with 20 mL of 5% formaldehyde solution were distributed to children from 0 to 16 years old, (including infants, pupils and middle-school children). Procedure for sample taking was explained to the parents. The samples were collected for 3–5 consecutive days. A total number of 178 containers were given and 115 of them (64.6%) were sent back to the laboratory.

One of the parents volunteered to record personal and environmental information. The following variables were assessed: a) personal: age, gender, number of children in the family and address; b) environmental: type of water supply, body waste disposal, garbage disposal; c) any pharmacological treatment; and d) previous contact with channel water (i.e. bath, recreation).

Stool samples were examined by using a wet mount (fresh and lugol). In addition two dyes were used for *Cryptosporidium* spp. searching: lugol and carbol fucshin for positive and negative staining respectively. Samples were also examined again after using two different concentration techniques: Faust (flotation) (Barlett *et al.*, 1978) and Ritchie (sedimentation) (Melvin & Brooke, 1982).

The studies were carried out according to the conditions of the Universal Declaration of Human Rights (1948), ethical standards instituted by the Nuremberg Code (1947), the Helsinki Declaration (1964), and subsequent amendments regulated by the National Law Nr. 25,326 related to data protection. Written permissions to work in the community were obtained from subjects, parents, or guardians. The results were also informed to the parents in order to start suitable medical treatments.

The chi-squared test and Student t-test were used for the analytic assessment. The differences were considered to be statistically significant when the p-value obtained was less than 0.05.

RESULTS

The frequency of infected people in the total studied population was 78.3%. Eleven species of parasites and commensalism parasites were found: six protozoa and five helminths (nematodes and cestodes). The prevalence of protozoa and intestinal helminths infection is shown in Table 1. The most frequent protozoa parasite detected was *Blastocystis hominis* (68.9%), in the 13–16 age group who are most affected. *Giardia intestinalis* was the second protozoa in frequency, with a prevalence of 33.3% and no significant difference between host age and prevalence was found ($p<0.05$). Among helminths, *Ascaris lumbricoides* was first in occurrence (38.9%) and children in pre-school age were the most affected (45.9%). *Trichuris trichiura* and *Strongyloides stercoralis* were in second place (13.3%).

Although infections frequencies due to *Entamoeba coli* and *Endolimax nana* were higher in males, in general we found no correlation between enteroparasitic infection and gender as shown in the Table 2.

In the study population 28.9% of the positive samples showed one parasite, 36.7% showed two parasites and 34.4% three or more parasites species. The overall superinfection rate was 71.1%.

DISCUSSION

The North Channel is a drainage channel where people living next to it used as garbage and feces dump. Besides that, some industries throw their liquid “wastes” and during the rainy season overflows are quite common. These situations make the channel change to an important source of infection for those who are in contact with the water, especially children. In addition, most families living at the side of the North Channel lacked of water connection inside the houses, street lighting, waste collection service (waste disposal is open), and laying of sewer

Table 1. Distribution of parasites in relation to age groups

	Infected cases by age (%)			
	0-5 (n=37)	6-12 (n=44)	13-16 (n=9)	Total (n=90)
Protozoa				
Blastocystis hominis	62.2	68.2	100.0	68.9
Giardia intestinalis	35.2	31.8	33.3	33.3
Entamoeba coli	27.0	20.4	33.3	24.4
Endolimax nana	16.2	9.1	11.1	12.2
Iodamoeba bütschlii	2.7	0.0	11.1	2.2
Chilomastix mesnili	8.1	4.6	0.0	5.6
Helminths				
Ascaris lumbricoides	46.0	36.4	22.2	38.9
Trichuris trichiura	16.2	6.8	33.3	13.3
Hymenolepis nana	5.4	9.1	11.1	7.8
Strongyloides stercoralis	8.1	15.9	22.2	13.3
Enterobius vermicularis	0.0	2.3	22.2	3.3

Table 2. Distribution of parasites in relation to gender

	Infected cases by gender (%)	
	Female (n=39)	Male (n=51)
Protozoa		
Blastocystis hominis	66.7	70.6
Giardia intestinalis	30.8	31.4
Entamoeba coli	15.4	31.4
Endolimax nana	7.7	15.7
Iodamoeba bütschlii	0.0	3.9
Chilomastix mesnili	5.1	5.9
Helminths		
Ascaris lumbricoides	35.9	41.2
Trichuris trichiura	12.8	13.7
Hymenolepis nana	7.7	7.8
Strongyloides stercoralis	10.2	15.7
Enterobius vermicularis	0.0	5.9

(latrines are in poor condition). Parasitic infections seem to be a common problem among this community living in such conditions. Parasitic protozoa and helminths are responsible for some of the most devastating and prevalent human diseases and constitute a medical and health problem including social and economic implications (Rosenfield *et al.*, 1984). Infection mechanism occurs primarily through drinking water and these results emphasize the risk represented by the water supplied to this community, which is not safe to drink, adding the probability of acquiring intestinal infection by accidental ingestion of water from the North Channel.

An important finding was the prevalence of intestinal protozoa *B. hominis* (68.8%), which was higher than in previous studies conducted in primary rural school children from the same province (54.4%) (Dib *et al.*, 2012). The present study showed that, *B. hominis* prevalence rate was 2.5 times higher in comparison to a study carried out in suburban schoolchildren from Buenos Aires, Argentina, where the incidence was 27.5% (Pezzani *et al.*, 2012). The patogenicity of *B. hominis* is still a matter for debate (Amato *et al.*, 2003), and its high prevalence coincides with the high prevalence observed for other protozoa. This may be explained because of transmission through contaminated water.

In the present work, high prevalence of *A. lumbricoides* infections was found in comparison with other authors in children in Argentina (Borda *et al.*, 1996; Guignard *et al.*, 2000). The negative consequences of helminth infections have been documented in diverse, populations (Stoltzfus *et al.*, 1997; Jardim Botelho *et al.*, 2008) and they have been linked with poor nutritional outcomes, including an increased risk for nutritional anemia, protein-energy malnutrition and growth deficient in children (Stephenson *et al.*, 2000a; Stepheson *et al.*, 2000b).

Compared to previous publications there is complete absence of two parasitic species, *Cryptosporidium* spp. and hookworm. Previous studies carried out in a town in Tucumán, showed hookworm prevalence was 9.2% (Valperga *et al.*, 1979). This difference could be explained due to climatic conditions and soil composition in the study area (i.e. variable temperatures, moderate rainfall and clay soils). Hookworm eggs are more dependent on these factors compared to other parasites. It is most probable that the soil from this area is less favorable for the survival of hookworm eggs. The occurrence of *E. vermicularis* infection is underestimated, as the procedure to look for *E. vermicularis* eggs, like the anal swab method, was not possible because of the characteristics of the population studied.

As in previous studies performed in Tucumán, a high prevalence of poly-parasitism was found (Silvia *et al.*, 2006; Dib *et al.*, 2012). The coexistence of different enteroparasitic species has also been observed in other places (Native-American communities) with known deleterious effects on health conditions (Nematian *et al.*, 2004; Devera *et al.*, 2005; Rivero *et al.*, 2007).

In conclusion, intestinal parasite infections caused by protozoa and helminthes constitute one of the main worldwide causes of human morbidity and mortality (Atias, 1999). In several provinces in Argentina over 50% of children are infected (Vergara *et al.*, 1996; Soriano *et al.*, 2005; Cesani *et al.*, 2007; Salomon *et al.*, 2007; Bracciaforte *et al.*, 2010). Our results indicated that parasitic infections are quite common (78.3%) in the North Channel community in concordance with other work carried out in Tucumán province where prevalence of parasite infection exceeded 80% (Silvia *et al.*, 2006; Dib *et al.*, 2012). This is an indicator that sanitary policies including environmental sanitation programs, health care, and sanitary education have been inadequate for the control of intestinal parasites as was shown in previous surveys in Argentina (Pezzani *et al.*, 1996; De Luca *et al.*, 1997; Basualdo *et al.*, 2000; Gamboa *et al.*, 2003). Therefore, it is imperative to promote, through sanitary policies, a genuine and extensive improvement in the living, social, and economic conditions of these communities that will help to reduce the occurrence of parasitic infections.

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