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Epidemiological Investigation for Intestinal Parasitic Infection in Children in Rural Communities in Paraguay

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Abstract

An epidemiological survey for parasitic infection involving 395 children aged under 12 years of age in 5 rural communities was carried out in Paraguay between October 1990 and May 1992. Intestinal parasites were detected by four methods – direct smear technique, formalin-ether sedimentation technique, agar plate culture method and the Harada-Mori filter paper strip culture technique.

Intestinal helminths and/or protozoa were detected in 270 fecal specimens (68.4%). Fifty seven point four percent of these specimens showed infection with a single parasitic species, while 28.1% showed double, 9.6% triple, 4.1% quadruple and 0.4% quintuple infection.

The most commonly observed helminth species in this study was *Necator americanus* (in 23.8% of samples), followed by *Ascaris lumbricoides* (10.6%), *Strongyloides stercoralis* (10.1%), *Hymenolepis nana* (2.3%), *Trichuris trichiura* (0.8%) and *Taenia* spp. (0.8%). The pathogenic protozoan species observed were *Giardia lamblia* (24.3%) and *Blastocystis hominis* (10.1%). Non-pathogenic protozoan species, *Entamoeba coli* (12.4%) and *Endolimax nana* (13.9%), were also observed. The highest prevalence of parasitism was observed in Areguá (92.7%), followed by Repatriación (89.6%), while the lowest prevalence was in Ñemby (35.4%).

Key words: helminth, protozoa, epidemiological investigation, children, Paraguay

Introduction

Morbidity due to intestinal parasitic helminth and protozoal infection is a major public health problem in developing countries, largely because of poor sanitary conditions. Parasitic infection is particularly prevalent in rural areas.

In the past, Paraguayan communities in both rural and urban areas have been surveyed for intestinal parasites (Canese *et al.*, 1975; Canese and Canese, 1976b; Brice, 1979; Cándido *et al.*, 1991a, b). However, the epidemiological data obtained from these studies is dated and sparse, and the quoted incidence of parasites varies widely. This is due to the fact that parasite detection mainly relied on only 2 methods, direct smear technique and Willis' flotation method. There is therefore a pressing need to accurately determine the infection status of people in Paraguayan communities, so that appropriate public health measures can be implemented.

The present study was undertaken to determine the current prevalence of intestinal parasitic infection in 5 rural communities of low socio-economic status in Paraguay. The results provide data for comparison with studies undertaken previously.

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Materials and Methods

Communities surveyed

This study was conducted in 4 communities on the outskirts of the capital city Asunción:– Areguá, Ñemby, Villeta and Itá, as well as one rural commu-

nity in the interior of the country, Repatriación (Fig. 1). The study was carried out between October 1990 and May 1992. Fecal samples of children under 12 years of age in each community were collected in plastic flasks, and examined within 4 hrs. of collection.

Stool examination

Four methods were used to detect intestinal parasites. (i) All fresh fecal samples were examined as saline wet mounts, fixed in 10% formalin solution. (ii) Formalin-ether sedimentation technique, which involves shaking approximately 2 g of each specimen in 8.5 ml of fixative with 1.5ml ether before centrifuging at 2000 rpm for 5 min. (iii) The agar plate culture method (Arakaki *et al.*, 1988) was used for detecting larvae of *Strongyloides stercoralis*. (iv) The Harada-Mori filter paper strip culture tech-

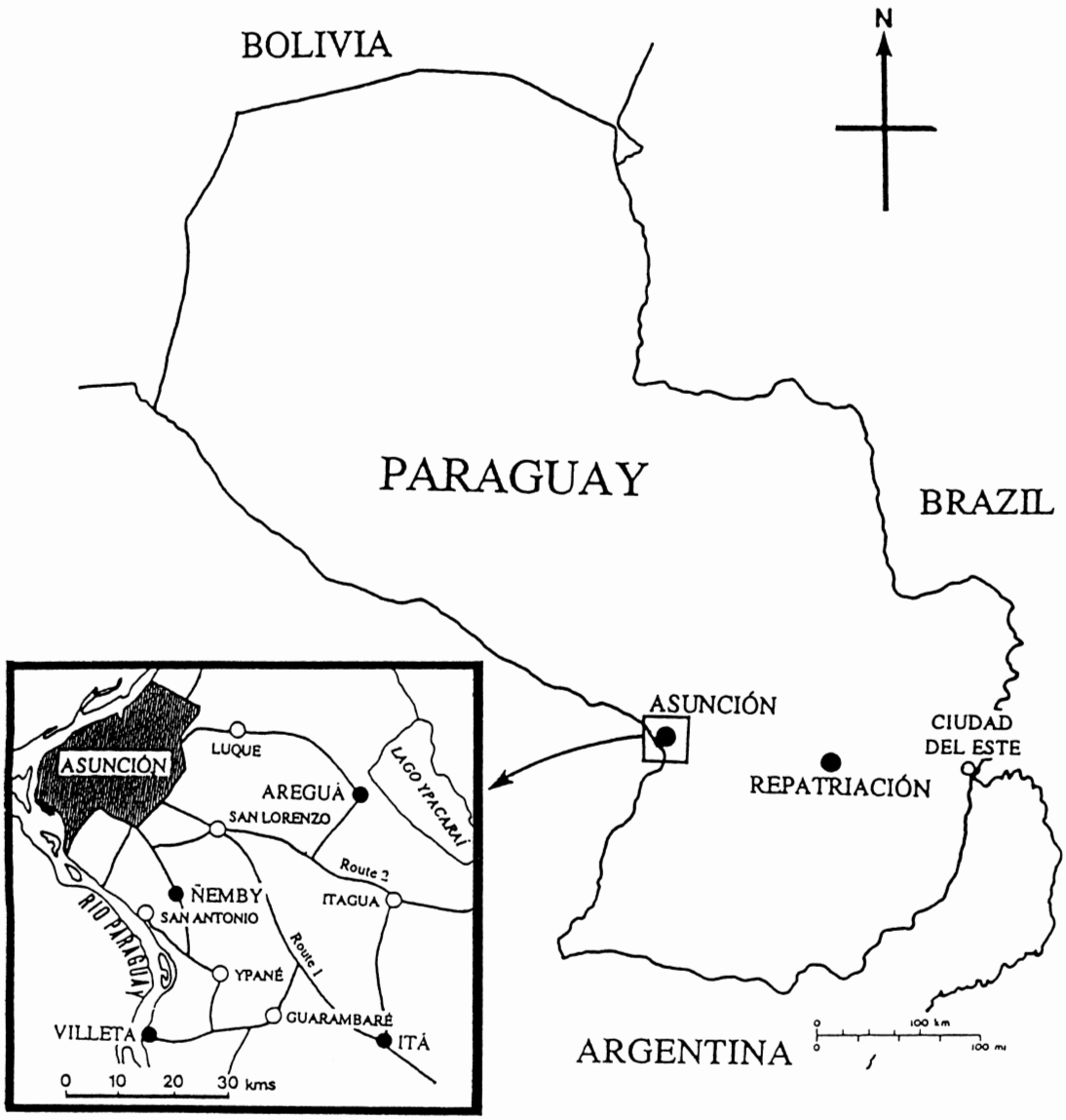

Fig. 1 Map of Paraguay showing the five study communities (• marked).

nique (Harada and Mori, 1955) was used for identification of nematode larvae, such as *Necator* and *Ancylostoma* parasites. Comparisons were made between the prevalence of infection of children in each age group and community.

Results

A total of 395 specimens were examined in this study. Intestinal helminth and/or protozoa infections were detected in the feces of 270 subjects (68.4%). Parasitic infection was recognized in all age groups, and even children under 1 year old had a comparatively high prevalence (up to 60%). The total number of children examined in each community and the overall results of this study are shown in Table 1. The most commonly observed helminth species in this study was *Necator americanus* (23.8% of total samples), followed by *Ascaris lumbricoides* (10.6%), *S. stercoralis* (10.1%), *Hymenolepis nama* (2.3%), *Trichuris trichiura* (0.8%) and *Taenia* spp. (0.8%). Geographic variation was marked among helminth parasite species, with *N. americanus* detected mainly in Areguá (49.1%), Itá (40.8%) and Repatriación (31.3%), *A. lumbricoides* in Areguá (45.5%), *S. stercoralis* in Itá (26.2%) and Repatriación (20.8%), and *H. nana* in Areguá (10.9%). Other species were detected from only a few communities and specimens. The pathogenic protozoan species observed were *Giardia lamblia* (24.3%) and *Blastcystis hominis* (10.1%). *G. lamblia* parasite was detected in all communities and showed a high prevalence, especially in Villeta (30.6%), Repatriación (29.2%) and Areguá (25.5%). *B. hominis* and the 2 non-pathogenic protozoan species, *Entamoeba coli* (12.4%) and *Endolimax nana* (13.9%) were also observed in all communities.

One hundred thirty eight specimens (39.2%) examined had infection with a single parasitic species, while 77 specimens (19.5%) had double, 26 specimens (6.6%) triple, 10 specimens (2.5%) quadruple and a single specimen (0.3%) quintuple infection. The most commonly observed parasite in single species infection was *G. lamblia* (52 specimens), followed by *E. nana* (32 specimens) and *N. americanus* (24 specimens). In double infections, *N.*

Table 1 Prevalence (%) of intestinal parasitic infection in children under 12 years of age in 5 communities in Paraguay, 1990–1992

Species	Community					
	Areguá	Ñemby	Villeta	Itá	Repatriación	Total
Year, Month examined	1990, Oct.	1991, Jun.	1991, Aug. 1992, Apr.	1991, Sep. 1992, Mar. 1992, May	1991, Nov. 1992, May	
Total no. of children examined	n=55	n=65	n=124*	n=103*	n=48*	n=395
Rate of parasite positive	92.7	35.4	65.3	69.9	89.6	68.4
Helminths						
Necator americanus	49.1	6.2	4.8	40.8	31.3	23.8
Ascaris lumbricoides	45.5	3.1	0	12.6	4.2	10.6
Strongyloides stercoralis	1.8	0	1.6	26.2	20.8	10.1
Trichuris trichiura	3.6	0	0	1.0	0	0.8
Hymenolepis nana	10.9	0	0.8	1.0	2.1	2.3
Taenia spp.	5.5	0	0	0	0	0.8
Protozoa						
Giardia lamblia	25.5	12.3	30.6	21.4	29.2	24.3
Entamoeba coli	21.8	6.2	12.1	7.8	20.8	12.4
Endolimax nana	0	7.7	21.0	16.5	14.6	13.9
Blastocystis hominis	20.0	3.1	12.9	7.8	6.3	10.1

*: Pooled analysis of samples from different seasons.

Table 2 Correlation between parasite species detected and age group in the 5 study communities (%)

Parasite species	Age group (years)				
	0–3 n=79	4–6 n=98	7–9 n=120	10–12 n=98	Total n=395
Helminths					
N. americanus	10.1	21.4	30.8	28.6	23.8
A. lumbricoides	8.9	5.1	15.0	18.4	10.6
S. stercoralis	7.6	12.2	11.7	8.2	10.1
T. trichura	0	0	1.7	1.0	0.8
H. nana	0	0	3.3	5.1	2.3
Taenia spp.	0	0	0.8	2.0	0.8
Protozoa					
G. lamblia	30.4	25.5	26.7	15.3	24.3
E. coli	6.3	11.2	14.2	16.3	12.4
E. nana	26.6	13.3	13.3	5.1	13.9
B. hominis	6.3	9.2	15.0	8.2	10.1

americanus and *S. stercoralis* were most commonly observed (17 specimens), followed by *N. americanus* and *G. lamblia* (8 specimens), and *A. lumbricoides* and *N. americanus* (7 specimens). Quintuple infection involving *N. americanus, A. lumbricoides, S. stercoralis, G. lamblia* and *E. coli*, was observed once, in a 6 year-old body in Itá. There was no difference in prevalence between males and females, but differences in age-specific distributions were found (Table 2). Children 8 years of age showed a higher prevalence for almost all parasite infections.

Analysis of results in each community examined showed that 92.7% of children in Areguá were infected with helminths and/or protozoa, followed by 89.6% in Repatriación, 69.9% in Itá, 65.3% in Villeta, and 35.4% in Ñemby.

Discussion

The social structure of Paraguay is undergoing profound change, with rural populations drifting towards the large cities. Economic growth, development and subsequent environmental degradation exacerbates the effects of this migration. Diseases encountered in this country are changing along with these transformations. Previously only Itá and Villeta (in the capital) have been subject to parasitological investigations (Canese and Canese, 1976b). The present report attempts to broaden the scope of investigation by including the provincial community of Repatriación, as well as two other communities on the outskirts of Asunción (Areguá and Ñemby).

Canese and Canese's (1976b) report included parasitological surveys in several communities in Paraguay between 1962 and 1974. More recently, 2 of these communities, Escobar and Guazú-Cuá in the Department of Paraguari, were again investigated (Cándido *et al.*, 1991a, b). In all of these publications, hookworm (mainly *N. americanus*), *A. lumbricoides, G. lamblia, E. coli* and *B. hominis* were reported to be the most common intestinal parasites throughout most of Paraguay. These latter studies indicate a decline in prevalence of all parasitic species, although all species of parasite previously reported were detected. There was no reported difference between males and females, nor between Villeta and Itá in the prevalence of each species of parasite.

In the current study, levels of infection with fecal-borne dermally transmitted parasites such as *Necator* and *Strongyloides* were high, and combined infection with both these nematodes was common. *Necator* alone, as well as its multiple infection with other parasitic species, was conspicuous. Most commonly affected were children aged 8 to 11 years, who were 51.9% positive in Itá. A

prevalence of *Strongyloides* infection of up to 20% was observed in Itá and Repatriación, but the age of children did not affect the chance of infection. Inquiries regarding the life-style of children and their families in each community (35.3% in Itá and 39.0% in Repatriación) revealed a greater tendency to go barefoot in communities with high *Necator* and *Strongyloides* infection compared with children in other communities (56.0% in Ñemby and 65.3% in Villeta). Another species of hookworm, *Ancylostoma duodenale*, was previously reported from Paraguay (Canese and Canese, 1976a; Masi *et al.*, 1976), but was not found in this study.

Ascaris infection showed a high prevalence only in Areguá (41.2%). Other species of helminth transmitted by oral transfer, *T. trichiura, H. nana* and *Taenia* spp., were detected from few children in the limited communities in this study, and their prevalence was nearly the same as reported previously. Infection with *Taenia solium* in humans and pigs and *T. saginata* in humans and cattle has been previously recorded in this country (Masi *et al.*, 1976), and the existence of neurocysticercosis (*T. solium* infection) has been confirmed in neighboring countries, such as Brazil, Chile and Peru (Schenone *et al.*, 1982). However, no cases of neurocysticercosis have been reported in Paraguay. If the species of *Taenia* spp. detected in this study is *T. solium*, it poses a considerable risk to public health.

Another characteristic recognized in this study was the high prevalence of protozoa detected in almost all communities. *G. lamblia* was the most common pathogenic intestinal protozoa detected. The incidence (12.3–30.6%) was lower than in previous investigations in Itá, 48%, (Canese and Da Silva, 1974), Escobar, 34.9%, (Cándido *et al.*, 1991b) and Guazú-Cuá, 31.3%, (Cándido *et al.*, 1991a), but infection in these communities generally showed higher prevalence than that in the other communities studied (Canese and Canese, 1976b). *Giardia* infection was found predominantly in children, particularly the 7 to 9 year age group in Areguá, 8 to 10 years in Villeta and 5 to 7 years in Repatriación. Another species of pathogenic intestinal protozoa, *Entamoeba histolytica*, was previously detected in Capiatá (1.0% of 275 stool samples), San Juan Bautista Ñeembucu (0.6% of 150 stool samples) and Asunción (0.5% of 475 stool samples) in 1972 (Canese and Canese, 1976b). However, this parasite was not found in any of the communities in the present study. No age correlation was recognized in children infected with *E. coli*, *E. nana* and *B. hominis*. Although *B. hominis* has recently been recognized as a pathogenic protozoan (Miller and Minshew, 1988; Doyle *et al.*, 1990), epidemiological and clinical data in this country are lacking.

Adequate freshwater and sewerage facilities are generally undeveloped in Paraguayan rural communites. The rate of freshwater consumption was 0% in Itá and Repatriación, 21.5% in Ñemby and 48.4% in Villeta, and inhabitants of these communities use mainly unboiled well, spring or rain water for drinking, cooking and washing. It appears that contaminated drinking water is the main source of the high level of fecal-oral transmitted parasites such as *A. lumbricoides, G. lamblia, E. coli* and *E. nana*.

Urgent attention should be paid to public health education for the inhabitants of these areas, coupled with provision of sanitary water supplies.

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