Intestinal Parasitism in San Cayetano, Corrientes, Argentina

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An epidemiologic study was conducted in San Cayetano, a village in the province of Corrientes, Argentina, to determine the prevalence of intestinal parasitoses in children. Eighty-eight households were randomly selected. Stool samples were collected from 207 children (72% of the school-age population and 12% of the total village population) over a period of six consecutive days, and were subjected to microscopic examination.

Of the samples examined, 170 (83%) contained one or more parasites, of which the most frequently found was Blastocystis hominis (in 43% of the samples). Other parasites and commensals detected included Giardia lamblia (29%), hookworms (27%), Entamoeba coli (27%), Enterobius vermicularis (4%), Strongyloides stercoralis (2%), and Ascaris lumbricoides, Trichuris trichiura, Taenia saginata, Isospora belli, Iodamoeba bütschlii, and Balantidium coli (each 0.5%).

The high observed prevalence of intestinal parasitoses indicates active parasite transmission in San Cayetano as a result of poor environmental hygiene — ascribable largely to a lack of public water supply, sewerage, and waste removal services.

Publications on intestinal parasitism in the province of Corrientes, Argentina, are dated and quite scarce. Surveys conducted between 1922 and 1943 focused primarily on the epidemiology and prophylaxis of hookworm disease and on legislation governing activities designed to combat it (1–5). One salient survey of the period was conducted in 1928 by de la Barrera and Riva (3), who carried out coprologic examinations for parasites using specimens from 2,000 children in 52 schools of the province. This survey demonstrated that geographic distribution of helminthiases within the province exhibited considerable variation. It also found hookworm infection to be the most significant helminthic parasitosis, to have a prevalence typically ranging from 75% to 100% in the northeastern sector of the province (between the Corrientes River, the lagoons and estuaries of the Ibera River, and the Paraná River) but averaging about 30% in the southeastern sector of the province, along the Uruguay River.

Since then, epidemiologic studies of hookworm infection suggested that its prevalence had not diminished much over the preceding 50 years. A study published in 1973 that was conducted by Borda (6) on the island of San Mateo in the Uruguay River found Necator americanus eggs in the stool specimens of 94% of the 86 individuals tested. A work published two years later, in 1975, by Borda et al. (7) surveyed 262 individuals in the northwest Corrientes village of San Cayetano and found 74% to be infested with hookworms — reaffirming that this particular parasitosis continued to represent a serious public health problem.
Moreover, it has been observed repeatedly that intestinal parasitoses are intimately related to underdevelopment and poverty, both of which have persisted without much change in northwestern Corrientes. For these reasons, it seemed appropriate to return to the village of San Cayetano to update available information on intestinal parasitism and examine prevailing sanitary conditions.

This article presents the results of a survey conducted from April to October 1993 on household sanitary conditions (specifically drinking water, waste removal, and excreta disposal) and the prevalence of intestinal parasites. The aims of the work were to provide parasitologists with information about the epidemiologic status of specific parasitoses endemic in the Corrientes region and thereby lay the groundwork for motivating health authorities to adopt control measures.

**MATERIALS AND METHODS**

Corrientes Province is situated in the humid subtropics of northeastern Argentina, between 28° and 29° south latitude. According to official 1988–1990 data, the mean temperature was 21.5 °C, the mean relative humidity was 76.6%, and the average annual rainfall was 138 cm. San Cayetano is located in the capital department, some 20 km by road southeast of the city of Corrientes near the Riachuelo River, a waterway that empties into the Paraná (Figure 1). It is the smallest village in the department, with 391 households and 1700 inhabitants, all Caucasian. The principal sources of income are subsistence farms and a meatpacking plant. The typical diet consists largely of vegetables and meat (beef or chicken). The village proper includes a police station, a town hall, a health center, and several churches.

Our 1993 study was carried out in three stages—the first in April, the second in May, and the third from June through October. In the first stage, parasitology educators and personnel from the National Center for Parasitology and Tropical Diseases (Centro Nacional de Parasitologia y Enfermedades Tropicales) located in Corrientes made repeated visits to the San Cayetano school (School 253) to inform teachers and parents about the survey’s aims and importance, the effects of parasitoses on family health and economic welfare, how parasitoses are transmitted, and how they can be prevented.

Subsequently, to start the second phase, 88 households (23% of the village total) were randomly selected. A group of surveyors trained at the National Center for Parasitology and Tropical Diseases then visited each household to assess each home’s construction and sanitary conditions—particularly drinking-water supply and methods used for excreta disposal and garbage removal. The surveyors also determined whether the children in the home had previously undergone any coproparasitologic testing or had been treated for an intestinal infection. In all, 312 children were identified in the households visited, of whom 286

![Figure 1. A map of the Argentine province of Corrientes showing the location of San Cayetano.](image-url)
were of school age and currently enrolled at the local school. Responses to the survey questions, which were asked orally of a parent or other adult in each family, were recorded on forms drafted at the Center.

When parental consent was requested for the 286 schoolchildren's participation in the third phase of the study, which involved examination of stool specimens, consent was only granted for 207 (72%), who constituted 12% of the entire village population.

After confirming that none of the 207 children had received any recent anti-parasite treatment, the surveyors gave their parents 30 mL plastic containers that had airtight lids and contained 10 mL of a 5% formol solution. Stool samples were collected over a period of six consecutive days and were taken to the National Center for Parasitology and Tropical Diseases in the city of Corrientes for microscopic examination. Each sample was processed using the technique of Hoffmann, Pons, and Janer (8); was treated with an iodine solution to render protozoan cysts visible; and was examined four times. In questionable cases, tincture of ferric hematoxylin was applied.

In those cases where hookworm eggs were detected, a fresh sample was taken in order to conduct a quantitative analysis using the technique developed by Borda and Pellegrino (9) and to determine the worms' genera by coproculture using the method of Harada and Mori (10). The various species of *Taenia* were identified by counting and morphologic analysis of their uterine branchings, after using xylol to clarify the segments.

RESULTS

Table 1 shows the distribution of the 207 study children by age and sex as well as the percentage of all village children with the specified age and gender represented by the study group. The percentages of village girls and boys included within the study group were similar for each age group except the oldest (14–16 years), which consisted only of boys.

The sanitary status of the 88 study households, only 55 (63%) of which had electricity, is shown in Table 2. The village did not have piped drinking water or a sewer system, and only 15 (17%) of the homes surveyed had septic tanks. Most (67, or 76%) had latrines, with 54 (82%) of these being less than 20 m from the water supply source. The inhabitants of the six remaining homes (7%) defecated on open ground. There being no garbage collection, 70 homes (80%) disposed of their waste by burning.

Examination of the stool samples revealed parasitic infestations in 170 (83%) of the study children. The samples from 64 were found to contain only one type of parasite, while samples from the remaining 106 yielded between two and five different species. In all, 16 different parasite and commensal species were found—these including two cestodes, six nematodes, and eight protozoans. Table 3 shows the detected prevalences of infestation by the various species. As can be seen, the most frequently found parasite was *Blastocystis hominis*, which was detected in 43% of the study children, followed by *Giardia lamblia*.
(29%), *Entamoeba coli* (27%), and various hookworms (*N. americanus*, 12%; *Ancylostoma duodenale*, 1%; mixed hookworms, 4%; and other unidentified species, 10%). The least frequently found parasites, each with a prevalence of 0.5%, were *Ascaris lumbricoides, Trichuris trichiura, Taenia saginata, Isospora belli, Balantidium coli, and Iodamoeba buttschlii*. No cases of infestation with *Entamoeba histolytica* were detected.

Table 4 shows the age distribution of the children infested with 11 parasites that our work has indicated are the most frequent in northeast Argentina. Hookworm infestations were light (1,000 to 1,999 eggs per gram of fecal matter) in 81%; moderate (2,000 to 5,000 eggs per gram) in 11%; and heavy (more than 5,000 eggs per gram) in 8%. On the other hand, *Ascaris lumbricoides, Trichuris trichiura, Strongyloides stercoralis,* and *Taenia saginata* were detected only in children between the ages of six and nine years.

Protozoan infestations were detected in all age groups, with prevalences generally being similar in both sexes.

**DISCUSSION**

Basic sanitation facilities in San Cayetano were found to be extremely poor. Although 25% of the homes surveyed had pumps, windmills, or other devices for extracting water from the subsoil through drilled wells, water for human consumption was not treated. In this regard, no difference was observed between this group of homes and those that obtained their drinking water from hand-dug wells or from the river, lakes, or ponds.

The village also lacked a sewer system. The latrines at homes that had them were generally found to be in substandard condition, lacking appropriate maintenance, and situated within 20 m of the home's water source—considerably short of the minimum 30 m separation recommended by PAHO (11).
Table 3. Numbers and percentages of study children with intestinal parasites, by sex, who were enrolled in the San Cayetano school as of October 1993.

<table>
<thead>
<tr>
<th>Parasites</th>
<th>Males</th>
<th></th>
<th>Females</th>
<th></th>
<th>Total</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No.</td>
<td>%</td>
<td>No.</td>
<td>%</td>
<td>No.</td>
<td>%</td>
</tr>
<tr>
<td>Hookworms (Necator americanus, Ancylostoma duodenale, etc.)</td>
<td>32</td>
<td>27</td>
<td>26</td>
<td>23</td>
<td>58</td>
<td>27</td>
</tr>
<tr>
<td>Ascaris lumbricoides</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0.5</td>
</tr>
<tr>
<td>Trichuris trichiura</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0.5</td>
</tr>
<tr>
<td>Strongyloides stercoralis</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Enterobius vermicularis</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>8</td>
<td>4</td>
</tr>
<tr>
<td>Hymenolepis nana</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Taenia saginata</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0.5</td>
</tr>
<tr>
<td>Giardia lamblia</td>
<td>29</td>
<td>25</td>
<td>31</td>
<td>34</td>
<td>60</td>
<td>29</td>
</tr>
<tr>
<td>Blastocystis hominis</td>
<td>51</td>
<td>44</td>
<td>38</td>
<td>41</td>
<td>89</td>
<td>43</td>
</tr>
<tr>
<td>Entamoeba coli</td>
<td>32</td>
<td>29</td>
<td>24</td>
<td>26</td>
<td>56</td>
<td>27</td>
</tr>
<tr>
<td>Isospora bellii</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0.5</td>
</tr>
<tr>
<td>Endolimax nana</td>
<td>4</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>7</td>
<td>3</td>
</tr>
<tr>
<td>Chilomastix mesnili</td>
<td>6</td>
<td>5</td>
<td>2</td>
<td>2</td>
<td>8</td>
<td>4</td>
</tr>
<tr>
<td>Iodamoeba bütchlii</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0.5</td>
</tr>
<tr>
<td>Balantidium coli</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0.5</td>
</tr>
<tr>
<td>Entamoeba histolytica</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Children with one or more parasites</td>
<td>91</td>
<td>79</td>
<td>79</td>
<td>86</td>
<td>170</td>
<td>82.6</td>
</tr>
</tbody>
</table>

Given the absence of a garbage collection system, 91% of the homes burned or buried their refuse while the remaining 9% piled it up in untreated garbage mounds.

The few published works on intestinal parasitism in Corrientes Province have focused exclusively on helminthiases, of which uncinariasis (hookworm disease) has shown the highest prevalences. In addition to the San Cayetano study published in 1975 (7), a subsequent San Cayetano study published in 1978 (12) found hookworm eggs in 70% of the 202 survey subjects. The current study found a much lower rate (27%) of hookworm infestation in the schoolchild population examined. This decline can be attributed to health education and mebendazole-based chemotherapy campaigns conducted between 1975 and 1978, which subsequent stool tests showed to have cured 85% of the members of 11 San Cayetano families of uncinariasis (12).

The most commonly encountered protozoan was Blastocystis hominis, which was found in 43% of the survey children. From the turn of the century until very recently, Blastocystis hominis was considered a harmless commensal; however, recent studies have shown that it has the ability to cause persistent and recurring diarrhea in both animals and humans (14–16).

Within the 14–16 age group, the small number of males and the total absence of females in our study population is explained by the fact that young people in this
age range had already left San Cayetano in search of work. Infestation with *Balantidium coli*, which was found in four children under 10 years old, could be attributable to the close manner in which the human inhabitants of San Cayetano coexist with the pig population. No cases of infestation with *Entamoeba histolytica* were found, even though the microscopic techniques used were those indicated for identifying that particular protozoan.

Overall, this study demonstrated once again that when lack of education and basic sanitation are added to conditions of poverty, the prevalence of intestinal parasitoses tends to be high. And while some people infested with parasites may be asymptomatic, in a good number of cases such individuals do in fact present symptoms.

In addition to the suffering that they cause, intestinal parasitoses have a widespread economic impact as a result of the high cost of medical care and the supply of medications they require. The high prevalence of parasitoses detected in our study (83%) approaches the prevalence of uncinariasis observed more than a half century ago, and the causes of the current problem are similar to those of that period. The sanitation measures adopted from the 1940s through the 1970s (such as installation of latrines, health education campaigns, and mass chemotherapy) produced less than optimum results because of their sporadic nature, short duration, and limited scope—as well as a lack of fundamental changes in either government policy or the living conditions of the populations involved.

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