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TOXOCARA CANIS INFECTION OF CHILDREN IN A CARIBBEAN COMMUNITY

Introduction

Toxocariasis is a public health problem in industrial countries, but few studies have examined the threat presented by this infection to the health of tropical communities. In a pilot study *(1)* we reported the use of enzyme-linked immunosorbent assay (ELISA) with embryonated *Toxocara canis* ova antigen (Toxocara-ELISA) *(2, 3)* as a method of detecting *T. canis* antibody in a sample population (n = 25) of Caribbean children. More than half of the children surveyed had significant antibody titers *(3)*, indicating that the prevalence of toxocariasis among the population was unusually high.

Another study was therefore carried out to quantify the significant epidemiologic factors influencing the transmission of *T. canis* to children in a Caribbean community and to identify factors that might contribute to the high seroprevalence of infection.

This study attempted to examine all children between six months and six years of age living in the coastal village of Anse-la-Raye, Saint Lucia. The children accompanied their parents or guardians to the community health center, where a brief clinical history and physical examination were completed. Each child provided a specimen of

feces, and this was analyzed in duplicate using the Kato technique *(4)* to determine the presence of helminth ova. Blood samples were taken from approximately every third child as part of a concurrent general health survey *(5, 6)*, and a 200 μl aliquot of plasma was separated and sent for seroanalysis to the U.S. Centers for Disease Control in Atlanta, Georgia. Serum samples were absorbed with *Ascaris* antigen before being assayed for the presence of *T. canis* by Toxocara-ELISA *(2)*.

In addition, the size of the dog population in Anse-la-Raye was estimated by direct visual search and by a house-to-house survey including 20% of all the residences in the village.

The prevalence of gastroenteric nematode infections among dogs in the village was estimated by collecting and analyzing specimens of canine feces from public roads and lands, as well as private lands at 22 locations throughout the village.

Finally, samples of surface soil (about 100 mg) were collected at 41 locations throughout the village and were analyzed for *T. canis* ova using the modified Dada-Linquist procedure *(7)*.

Results

During the course of the study 203 children were examined; they constituted about 85% of the estimated population six months to six years of age in Anse-la-Raye. The prevalence of infection with *Trichuris trichiura* was 84%, *Ascaris lumbricoides* 62%, and hookworm (probably *Necator americanus*) 7%. *Enterobius vermicularis* ova were found in some stools, but the Kato technique does not allow their quantification. Transmission of *Schistosoma mansoni* does not occur in the immediate area of the village, and no schistosome ova were identified in the stool samples.

Sera were collected from 82 of these children (40%); and, after preabsorption with *Ascaris* antigen, the sera were analyzed using the Toxocara-ELISA technique. Significant titers ($>1:32$) *(2)* of *T. canis* antibody were found in 86% of the serum samples.

The clinical features exhibited by the *T. canis* seropositive subpopulation are shown in Table 1. The gastroenteric symptoms are compatible with colitis, and its occurrence correlates statistically with heavy worm burdens of *T. trichiura (5)*. The respiratory symptoms are consistent with visceral larva migrans *(8)*, but do not correlate statistically with *T. canis* seropositivity. The reticuloendothelial symptomatology is of unknown etiology and does not correlate statistically with the presence of any of the pathogens identified in the study; however, nine cases of hepatomegaly and one case of hepatosplenomegaly were all seropositive.

The parents or guardians of 33% of the seroanalyzed children reported that the children had a history of frequently ingesting soil. This geophagic behavior correlates with the presence of frank gravel or sand in stool samples ($X^2 = 36.66$; $P > 0.01$; degrees of freedom = 1). All of the individuals with pica yielded seropositive Toxocara-ELISA tests.

TABLE 1. Clinical signs in children with a Toxocara-ELISA titer >1:32 in the Saint Lucia survey, 1982.

Clinical sign	Proportion (%)
Gastroenteric:	
Frank blood in stool	36
Mucus in stool	29
Diarrhea (>3 stools/day)	27
Respiratory:	
Wheeze	29
Shortness of breath	24
Cough	63
Reticuloendothelial:	
Palpable liver	14
Palpable liver and spleen	2
Palpable axillary lymph nodes	62
Anthropometry:	
<80% Weight for age	18
<95% Height for age	45
<90% Weight for height	16

Canine infections. Table 2 shows the prevalence of canine nematode infections in Anse-la-Raye, as determined by analysis of fecal specimens collected from 22 locations. Thirty-two per cent of these specimens contained *T. canis* ova, and 64% contained the ova of one or more of five nematode species. The total dog population in Anse-la-Raye was estimated at 530 dogs. During visual surveys of the village 51 dogs were observed. Since only approximately 10% of the village could be surveyed in this way, that value is consistent with the above estimate of the total dog population.

Soil samples. Of the soil samples (n = 41) collected around the village, 19.5% contained identifiable *T. canis* ova. It is noteworthy that 46% of the samples (n = 13) from the school playground and recreational area were positive.

TABLE 2. Prevalence of nematode ova in canine fecal specimens collected from 22 sites in Anse-la-Raye, Saint Lucia, 1983.

Parasite species	Proportion (%)
Ancylostoma spp.	36
Spirocerca lupi	9
Toxascaris leonorum	32
Toxocara canis	32
Trichuris vulpis	23

Discussion and conclusions

The seroprevalence of *T. canis* found in the present study is considerably higher than that reported in previous investigations (Table 3). That this may have arisen from an artefact caused by cross-reactivity with other helminth antibodies was discounted, since there was no significant reduction in Toxocara-ELISA titers when sera were pre-absorbed with *T. trichiura* and/or *Ascaris* antigen. This is also consistent with the low levels of cross-reactivity detected in previous Toxocara-ELISA studies *(2, 9, 10)*. While this increases confidence in the serologic result described here, it provides no explanation for the high seroprevalence of *T. canis* in Anse-la-Raye.

Comparison of our results with those from coprologic and autopsy studies of dog populations in 13 countries *(1, 12, 19, 20, 27–38)* indicates that the prevalence of *T. canis* among dogs in Saint Lucia is high, but not exceptionally so. It should be noted that our sampling technique probably results in overrepresentation of the more mobile and venturesome dogs. These animals may make the major contribution to the dissemination of *T. canis* ova in the environment *(11)*, although the highest prevalence of infection is in pups under six months old *(12, 13)*.

Even if the prevalence of canine infection is not abnormally high, increased environmental contamination with *T. canis* ova could still occur if the infected dog population was large and unconstrained. The canine population in Anse-la-Raye is 28% of that of the human population and is distributed among 77% of the households. In contrast, the US canine population is approximately 15% of that of the human, and dogs are found in only 30–50% of the households *(13)*. Also, in the study village the dogs roamed freely throughout the village.

TABLE 3. Seroprevalences of *Toxocara canis* infection in humans as determined by ELISA.

Country	Subjects	Prevalence (%)	Reference
Iraq	Healthy adults	7.3 (219)[a]	*22*
Netherlands	Healthy children	7.1 (112)	*23*
Saint Lucia	Rural children	86.0 (82)	Present study
United Kingdom	Healthy adults	2.6 (992)	*24*
	Dog exhibitors	15.7 (102)	*25*
United States	Mixed age[b]	30.0 (2,606)	*13*
	Mixed age[b]	54.0 (43)	*26*
	Healthy controls	9.0 (44)	

[a] Figures in parentheses are the numbers of positive subjects.
[b] Suspected of having visceral larva migrans.

The prevalence of *T. canis* in soil samples is comparable to that reported in other countries *(22, 29, 34, 39–41)*. However, prevalences in soil samples should be interpreted with caution. The prevalences of *T. canis* in the soil of northern temperate countries refer to public parklands, which may be specifically selected by dog owners for the defecation of their campanion animals. In contrast, the prevalence in the soil samples of Anse-la-Raye represents the level of contamination of the village as a whole, and probably reflects the promiscuous defecatory behavior of the unconstrained dog population.

Sources of *T. canis* ova are abundant in the peridomestic environment of Anse-la-Raye, but to infect humans the eggs have to be ingested. This could arise via hand-to-mouth transfer or by consumption of contaminated food. The absence of adequate water supplies—few dwellings in the study village had piped water—and consequent low standards of hygiene in the study village make both of these routes of infection highly probable *(5)*. A possible third route is the deliberate ingestion of soil containing infective ova. The study indicates that almost a third of the children in the village exhibited overt geophagia, while anecdotal information suggests that less overt "dirt eating" is an almost universal trait among children in the region. Previous studies have shown that pica is consistently associated with visceral larva migrans *(14–16)*, and our results indicate that all children with overt pica were seropositive in Toxocara-ELISA tests. The two factors were not, however, statistically correlated, perhaps because of the asymmetric distribution of infection in the population.

We suggest that the apparently high seroprevalence of infection of children with *T. canis* in the study village could arise from a combination of factors: a high prevalence of infection in a large, untreated, and unconstrained dog population; generally low standards of hygiene; and frequent geophagic behavior among children. This combination of factors is not unusual in lower socioeconomic groups in the Caribbean, and thus a generally high prevalence of *T. canis* infection of humans might be expected in this region.

The public health significance of these findings is not clear. We were unable to demonstrate any clear association between the low health status of the pediatric population and infection with *T. canis*. Human toxocariasis has a pleomorphic symptomatology *(16)*, and only the most dramatic forms of the disease—visceral larva migrans and ocular larva migrans—have been identified previously in the Caribbean *(3, 17–19)*. Nevertheless, the clinical consequences of the migration of *T. canis* filariform larvae in tissue have been described elsewhere *(14–16, 20, 21)*, and it appears inevitable that the apparently high prevalence of infection in the village will adversely affect the health of local children.

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