Prevalence of Toxoplasma gondii antibodies in stray and owned dogs of Grenada, West Indies

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Abstract

Aim: This serological survey was undertaken to estimate the prevalence of Toxoplasma gondii in two populations of dogs (stray and owned dogs) in Grenada. Dogs get infected with oocysts voided from cats, definitive hosts of T. gondii. In dogs, T. gondii causes subclinical to clinical disease. Earlier studies conducted in Grenada on a small population of owned dogs showed evidence of exposure to T. gondii.

Materials and Methods: Antibodies to T. gondii were determined in serum samples from 625 dogs (368 stray and 257 owned dogs) from around all six parishes in Grenada, West Indies, using an indirect enzyme linked immunosorbent assay.

Results: Antibodies to T. gondii were found in 123 (33.4%; 95% confidence interval [CI]: 28.58-38.22%) of stray dogs and in 64 (25%; 95% CI: 19.71-30.29%) of the owned dogs. Seropositivity was higher in stray dogs than in pet dogs (p=0.026). Whereas, there was no sex predisposition to seropositivity in owned dogs (p=1.0), female stray dogs showed a higher prevalence than male stray dogs (p=0.04).

Conclusion: These results support previous findings that T. gondii is prevalent in Grenada. In this study, overall seropositivity for T. gondii in dogs in Grenada is lower than noted in 2008, but is still higher in stray dogs than in owned dogs.

Keywords: dog, ELISA, Grenada, T. gondii.

Introduction

Toxoplasma gondii is a coccidian parasite that is widely prevalent in all warm blooded animals including humans worldwide [1]. T. gondii is an important zoonotically as it causes congenital defects or abortion and fatal disease in immunocompromised humans. Humans and other animals can become infected by ingesting tissue cysts from undercooked meat or from food or drink contaminated with oocysts shed in cat feces. Dogs play an important role in the mechanical transmission of oocysts to humans. Dogs roll in cat feces and other smelly substances, thus contaminating their fur, serving as a source of infection to young children [2]. Humans also become infected by consuming undercooked dog meat where dogs are used for food [3].

Not all T. gondii infected dogs show clinical signs. However, T. gondii causes respiratory, alimentary and neurological signs and muscular abnormalities occasionally in conjunction with viral infection and stress [3,4]. To the best of our knowledge, there is no published report on the prevalence of T. gondii in dogs in the Caribbean countries except Grenada. The prevalence of T. gondii antibodies has been reported in dogs, pigs, sheep, goats, and cattle in Grenada, West Indies [5,6]. In 2008, a study using the modified agglutination test (MAT) on 107 dogs revealed 48% positivity for T. gondii in Grenada [5].

The present study assessed the prevalence of T. gondii antibodies in two populations of dogs (stray and owned) from all the six parishes of Grenada, West Indies.

Materials and Methods

Ethical approval

The project was approved by Institutional Animal Care and Use Committee of the St. George’s University, Grenada.

Test procedure

Blood samples were collected by venipuncture in owned and stray dogs. The owned dogs were part of the “one health one medicine” fair and vaccine clinics organized by veterinary students and the faculty from the School of Veterinary Medicine, St. George’s University Grenada. Stray dogs captured by the Ministry of Health in conjunction with the Ministry of Agriculture, Land, Fisheries and Environment,
Government of Grenada under the stray dog control program were used in the study. A volume of 2 ml of blood was obtained from each animal. The blood samples were transported, within 2 h of collection, to the research laboratory at seminal vesicle mesenchyme and centrifuged for 10 min at 1500 g. The separated sera were stored frozen at (−20°C) until analysis. The presence of T. gondii antibodies was analyzed in duplicate by indirect enzyme linked immunosorbent assay (ELISA) (ID screen toxoplasmosis-indirect IDVet, France). Frozen serum samples were thawed and diluted 1:10 before ELISA test. The protocol was followed as directed in the IDVet indirect ELISA kit.

### Statistical analysis
Confidence intervals (CI) were calculated using the following website: (http://www.mccallumlayton.co.uk/states/confidence_intervalCalcProportion.aspx).

### Results
In the present study, a total of 625 dogs (368 stray dogs and 257 owned dogs) were examined. Based on this sample population seropositivity for T. gondii was 123 (33.4%; 95% CI: 28.58-38.22%) for the stray dogs and 64 (25%; 95% CI: 19.71-30.29%) for the owned dogs (Table-1). This investigation also showed that the prevalence in female stray dogs was 37.7% (95% CI: 31.3-44.1%) and 27% (95% CI: 19.85-34.15%) in male stray dogs, whereas that for owned dogs 22.5% (95% CI: 15.03-29.97%) in female and 27% (95% CI: 19.57-34.43%) in male dogs (Table-2).

### Discussion
Researchers have used different laboratory methods to detect seroprevalence of T. gondii in dogs in different countries. MAT is most widely used [7-10]. MAT is now indicated to give false positives due to cross reactivity. Latex agglutination test (LAT) has also been used [3,19]. ELISA has recently been used by many researchers [17,19-21]. Limited studies comparing merits and demerits of various methods in serology of T. gondii are available. Miereles et al. [21] comparing ELISA with IHA recommended superiority of ELISA. We also used ELISA in this study, with ID screen toxoplasmosis indirect multispecies kit. The manufacturer (IDvet France) reports 100% specificity and 100% sensitivity of their ELISA kit.

In the present study, the overall seropositivity for T. gondii in stray dogs was significantly higher (33.4%; 95% CI: 28.58-38.22%) than in owned dogs (25%; 95% CI: 19.71-30.29%) (p=0.026). In Grenada large numbers of stray dogs are found roaming the streets, fresh open markets and public places allowing for potential exposure to T. gondii oocyst contaminated environment, compared to owned dogs which are mostly indoor and are less likely to be exposed to T. gondii.

Similar results have been found in other studies. In Pakistan, Ahmad et al. [14] reported 78.5% in stray dogs and 34.6% in owned dogs; whereas Jadoon et al. [12] found 83.33% positivity in stray dogs and 37.95% in owned dogs. In Iran a seroprevalence of 31.2% in stray dogs and 9.03% in owned dogs was reported by Hosseinininejad et al. [22], while Shadfar et al. [20] in Iran found 77.7% in stray dogs and 40% in owned dogs. Thy et al. [13] in Korea, while comparing the prevalence of antibodies in stray dogs with owned dogs, found a higher proportion in stray (18.5%) than in owned dogs (5.1%). Other researchers, although not comparing two population of dogs (stray vs. owned) reported high positivity in stray dogs (51.3%) in Turkey [17]; 40.3% in an urban rural gradient in China [20]; 67.4% in Sri Lanka [7]; 38.0% in Portugal [8]; 50.5% in Brazil [23]; 16.8% in Colombia [22]. A low seropositivity (10.81%) has been found in owned dogs in Northwest China [9]; 3.50% in Southwestern China [3]; 10.0% in Northwestern China [20]; 30.9% in Northeastern China [10] and 25.9% in Czech Republic [16].

The difference in seroprevalence amongst different parts of the world suggests that climatic changes influence the prevalence of T. gondii, in which warmer and moist conditions have a higher seroprevalence.

### Table-1: Seroprevalence of T. gondii in stray and owned dogs from Grenada.

<table>
<thead>
<tr>
<th>Type of dog</th>
<th>Number of tested</th>
<th>Number of positive</th>
<th>Percent positive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stray dog</td>
<td>368</td>
<td>123</td>
<td>33.5</td>
</tr>
<tr>
<td>Owned dog</td>
<td>257</td>
<td>64</td>
<td>25.0</td>
</tr>
</tbody>
</table>

Fisher’s exact test (stray dogs vs. owned dogs): p=0.0263. There is a significant difference in seropositivity to T. gondii between stray and owned dogs. T. gondii = Toxoplasma gondii

### Table-2: Seroprevalence of T. gondii in stray and owned dogs according to gender

<table>
<thead>
<tr>
<th>Sex</th>
<th>Stray dogs</th>
<th>Number of positive</th>
<th>Percent</th>
<th>Owned dogs</th>
<th>Number of positive</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>148</td>
<td>40</td>
<td>27.0</td>
<td>137</td>
<td>37</td>
<td>27.0</td>
</tr>
<tr>
<td>Female</td>
<td>220</td>
<td>83</td>
<td>37.7</td>
<td>120</td>
<td>27</td>
<td>22.5</td>
</tr>
</tbody>
</table>

Fisher’s exact test (stray dogs male versus female): p=0.04, There is a significant difference in seropositivity to T. gondii between stray female dogs and stray male dogs. Fisher’s exact test (pet dogs-male versus female): p=1.0000, There is no significant difference in seropositivity to T. gondii between owned female dogs and owned male dogs.

T. gondii = Toxoplasma gondii
The moist and warm conditions that we have in Grenada make the oocysts more viable than in dry, hot, or cold climates [17].

Since cat is the primary host, seropositivity of T. gondii in cats bears a relationship with seropositivity in dogs [15,16]. In Grenada, antibodies to T. gondii were found in 57% of pregnant women and 35% of cats [24]. Yet again in 2009, screening for T. gondii antibodies in domestic and feral cats was undertaken using a MAT, with seropositivity in 30.6% of domestic cats and 27.7% of feral cats [25]. In Grenada a decreasing rate of seropositivity in cats from these studies correlates well with a concurrent decrease in seropositivity in dogs observed in the current study and also an earlier report [5].

Statistical analysis showed that difference in T. gondii infection between female and male stray dogs was significant (p=0.04), whereas in owned dogs there was no significant difference in gender (p=1.0). Previous researchers [8,9,13,14,16,22,26,27] did not find a significant difference in T. gondii antibodies between male and female stray and owned dogs. Shadfar et al. [20] reported higher antibody titers in male owned dogs; and Alain et al. [28] in owned dogs found bitches 2.5% more infected with T. gondii.

Conclusion

The overall seropositivity for T. gondii in dogs in Grenada in this investigation is lower than that reported in 2008, and the percentage remains higher in stray dogs than in owned dogs and is therefore of a concern to both animal and human health.

Recommendation

Since stray dogs and cats may act as reservoirs of many zoonotic diseases in addition to T. gondii, a stray dog and cat control program should be instituted in Grenada.

Authors’ Contribution

TP and CA collection of blood from owned and stray dogs respectively, AC, KT and GO conducted ELISA, AC also did statistical analysis, RNS preparation of project, overlooked all aspects of the project and manuscript writing with GO and MIB draft and revision of the manuscript. All authors read and approved the final manuscript.

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Competing Interests

The authors declare that they have no competing interests.

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