Prevalence of Toxoplasma gondii in Chickens From an Area in Southern Brazil Highly Endemic to Humans

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Abstract: The prevalence of Toxoplasma gondii in free-range chickens from Campos dos Goytacazes, Rio de Janeiro State, Brazil, was examined to evaluate environmental contamination by oocysts. Antibodies against T. gondii were assayed by the modified agglutination test.

There is evidence that S. cruzi and S. hominis of cattle are transmissible to water buffalo in China (Xiao et al., 1991; Zuo et al., 1995; Yang et al., 2001). The finding of as many as ~5,000 sarcocysts per gram of muscle in buffalo no. 1 and no sarcocyst in buffalo no. 2 suggests that buffalo no. 1 acquired infection from the inoculum we fed and not from spontaneous infection, although buffalo no. 1 was only 5 mo old, whereas buffalo no. 2 was 13 mo old. Thus, we believe that buffaloes can act as the intermediate host for S. hominis, at least under experimental conditions. Huong et al. (1999) identified a new species, S. dubeyi, from water buffaloes in Vietnam, which is similar to S. hominis ultrastructurally. It remains to be determined whether S. dubeyi sarcocysts in Vietnam are the same as or different from the S. hominis sarcocysts observed in the present study.

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LITERATURE CITED


Toxoplasmosis is a ubiquitous infection caused by ingestion of *T. gondii* tissue cysts in undercooked meat or by ingestion of food or water contaminated with oocysts excreted by infected felids (Dubey and Beat- tie, 1988). The virtual absence of *T. gondii* infection in localities not inhabited by cats (Wallace, 1969; Munday, 1972; Dubey et al., 1997) emphasizes the epidemiological importance of oocysts in the worldwide distribution of *T. gondii*. Because *T. gondii*-contaminated soil is likely to be a continuous source of infection for animals and humans, the prevalence of *T. gondii* in naturally infected feral chickens may be considered as an indicator of the presence of *T. gondii* oocysts in the environment due to the geophagic eating habits of these animals (Ruiz and Frenkel, 1980).

In a recent survey of the prevalence and risk factors associated with *T. gondii* infection, undertaken in Campos dos Goytacazes (Campos), Rio de Janeiro State, Brazil, age and socioeconomic (SE) status were found to be the strongest predictors of *T. gondii* seropositivity. Adjusted for age, 84% of the people of lower SE status had *T. gondii* infection (Bahia-Oliveira et al., 2003). Because *T. gondii*-infected soil is likely to occur during flooding or heavy runoff, which are common in Campos after rainfall. The present work was undertaken to evaluate the prevalence of *T. gondii* infection in chickens as an indicator of soil contamination with *T. gondii* oocysts in an endemic area of toxoplasmosis in Brazil.

Campos is located at 21°5′15″N, 41°19′28″W, 287 km from Rio de Janeiro capital, and its altitude is 13 m. It is the third most economically important city of the state, with a population of about 400,000. Nearly 6% of the local population belongs to the low-SE strata conforming to 32 economically deprived communities, which live in 15 areas with urban, suburban, or rural characteristics, often with no running water or residential sewage facility. The 15 areas are spread in the city and do not form a continuum from urban to rural communities.

To select a geographically representative area, chickens from houses of people of the low-SE strata in 7 of the 15 poor areas of the city were selected randomly as samples by using the following procedure. Each area was given a number. Areas were then selected using a table of random numbers. These 7 areas corresponded to places where about 3% of the total population of Campos lives and include 18 separate communities. From these 18 communities, 9 were selected randomly using the method just described. This also assured adequate geographic representation in the city. It was not possible to select households at random because there is no systematic spatial organization such as conventional streets, quarters, or blocks; a visual sampling scheme was applied to select houses throughout the communities. All the owners of dwellings who were contacted and had chickens on their property agreed to participate in the survey. The number of chickens sampled for each dwelling varied from 1 to 3, which closely represented 50% of the chickens living in, or around, the properties. The size of the properties ranged from 50–200 m² for urban and suburban areas to 400–1,000 m² for rural areas.

One hundred and ninety-eight free-range chickens (*Gallus domesticus*) in, and around, 93 properties were surveyed from June to August 2001. The chickens weighed 0.8–2.5 kg. The chickens were bled from a wing vein, and frozen serum samples were transported by air from Campos to the U.S. Department of Agriculture (USDA) laboratory in Beltsville, Maryland. Modified agglutination test (MAT) was used to evaluate antibodies to *T. gondii*, as described by Dubey and Desmonts (1987). Initially, sera were screened at 1:25, 1:50, and 1:100 dilutions. Subsequently, some sera were tested in 2-fold serial dilutions from 1:10 to 1:1,000.

To validate the serological results, the presence of viable *T. gondii* was next evaluated by testing tissues from 86 of the 198 chickens, using a mouse bioassay. Chickens were initially maintained in an enclosed area at the Universidade Estadual do Norte Fluminense for 2 mo and were then killed by cervical dislocation. Brain, heart, and blood samples were collected from each chicken, stored at 4–6 °C, and carried by 1 of us (D.S.S.) from Campos, Brazil, to Beltsville, Maryland, 1 day after killing.

Brain and heart from each chicken were pooled, homogenized, and digested in HCl–pepsin solution (Dubey, 1998). The sediment was reconstituted in phosphate-buffered saline (0.15 M, pH 7.2), neutralized with sodium hydroxide, mixed with antibiotics (penicillin 1,000 UI and streptomycin 100 μg/ml, final concentration), and inoculated s.c. into 5 Swiss Webster female albino mice (Taconic Farms, German Town, New York), as described by Dubey (1998) and Dubey et al. (2002). Fresh smears of lungs or brain (or both) of the mice that died after inoculation with chicken tissues were examined for the presence of *T. gondii*. Survivors were bled 1 mo after inoculation, and serum samples were tested for antibodies to *T. gondii* by MAT, using a 1:25 dilution. After serological testing, mice were killed and examined for tissue cysts, irrespective of serology (Dubey and Beattie, 1988).

Statistical analyses were performed by chi-square test for linear trend, with a 95% confidence interval (EPINFO 2000). Antibodies to *T. gondii* were found in sera of 129 of the 198 chickens tested (Table I), from 97 dwellings of the county with urban, suburban, or rural characteristics.

**Table I. Prevalence of Toxoplasma gondii in chickens from Campos, Rio de Janeiro, Brazil.**

<table>
<thead>
<tr>
<th>Community code no.</th>
<th>Predominant characteristic of the region*</th>
<th>No. of chickens (n = 198)</th>
<th>No. (percentage) of chickens with <em>T. gondii</em> antibodies</th>
<th>Total seropositive (≥1:10, n = 129)</th>
<th>Percent seropositive (≥1:10)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 R</td>
<td></td>
<td>58</td>
<td>4 (6.8)</td>
<td>28 (48.2)</td>
<td>32</td>
</tr>
<tr>
<td>2 SB</td>
<td></td>
<td>27</td>
<td>3 (11.1)</td>
<td>16 (59.2)</td>
<td>19</td>
</tr>
<tr>
<td>3 SB</td>
<td></td>
<td>15</td>
<td>1 (6.6)</td>
<td>8 (53.3)</td>
<td>9</td>
</tr>
<tr>
<td>4 U</td>
<td></td>
<td>5</td>
<td>0 (0)</td>
<td>5 (100.0)</td>
<td>5</td>
</tr>
<tr>
<td>5 SB</td>
<td></td>
<td>27</td>
<td>2 (7.4)</td>
<td>14 (51.8)</td>
<td>16</td>
</tr>
<tr>
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<td></td>
<td>10</td>
<td>2 (20.0)</td>
<td>7 (70.0)</td>
<td>9</td>
</tr>
<tr>
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<td>17</td>
<td>2 (11.7)</td>
<td>8 (47.0)</td>
<td>10</td>
</tr>
<tr>
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<td></td>
<td>12</td>
<td>1 (8.3)</td>
<td>6 (50.0)</td>
<td>7</td>
</tr>
<tr>
<td>9 U</td>
<td></td>
<td>27</td>
<td>6 (22.2)</td>
<td>16 (59.2)</td>
<td>22</td>
</tr>
</tbody>
</table>

* R, rural, SB, suburban, U, urban.
large property in comparison with that observed for chickens from small property in the present study is similar to the lower prevalence that was found for persons from the low-SE population living in rural areas in comparison with that found for persons living in urban and suburban localities of Campos (Bahia-Oliveira et al., 2003). In general, the properties in rural areas are larger than those in urban or suburban localities. The smaller space for deposition of animal waste in urban or suburban regions in comparison with the space in rural areas might explain these differences.

The results of the present study indicate that the environment near human dwellings in 7 impoverished areas of Campos is contaminated with T. gondii oocysts and that the most likely sources of T. gondii infection of chickens surveyed is either soil or water (or both) contaminated with oocysts.

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**LITERATURE CITED**


