Prevalence of Agglutinating Antibodies to *Toxoplasma gondii* in Adult and Fetal Mule Deer (*Odocoileus hemionus*) From Nebraska

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ABSTRACT: Toxoplasma gondii is an apicomplexan parasite of mammals and birds. Herbivores acquire postnatal infection by ingesting oocysts from contaminated food or water. Toxoplasma gondii infection is common in white-tailed deer, Odocoileus virginianus, but little is known about the prevalence of infection in mule deer, O. hemionus. We examined sera from 89 mule deer from Nebraska for agglutinating antibodies to T. gondii using the modified direct agglutination test (MAT) with formalin-fixed tachyzoites as antigen. Thirty-one (35%) of the 89 mule deer (78 females and 11 males) were positive for parasites, positive for Toxoplasma gondii, Neospora caninum, and Sarcocystis neurona. The MAT was used to screen all sera at a 1:25 dilution. Positive sera were further tested at dilutions of 1:50, 1:100, and 1:500.

Mule deer, Odocoileus hemionus, have been shown to be natural intermediate hosts (Dubey, 1982) for the zoonotic protozoan parasite, Toxoplasma gondii. These animals can suffer acute fatal infections if they ingest as few as $1 \times 10^5$ T. gondii oocysts (Dubey et al., 1982). Studies of the prevalence of antibodies to T. gondii in mule deer have been limited in number. Toxoplasma gondii infection in hunters associated with consumption of white-tailed deer meat has been reported (Sacks et al., 1982; Ross et al., 2001). The present study was done to examine the prevalence of antibodies in mule deer collected in Nebraska.

Mule deer were collected from the southwestern portion of the Nebraska panhandle from Cheyenne (n = 42; 39 females, 3 males), Deuel (n = 1, female), and Kimball (n = 46; 38 females, 8 males) counties during March and April of 2001. Samples were collected from the fetuses of 29 mule deer and examined using the modified direct agglutination test (MAT). However, the mothers of 15 of these fetuses were positive in the MAT, and 2 were males. The overall prevalence of antibodies to T. gondii was 31 (40%) of 78 females and 2 (18%) of 11 males. None of the 29 fetuses examined were positive in the MAT, however the mothers of 15 of these fetuses were positive in the MAT (1:25 N = 2; 1:50 N = 5; 1:100 N = 7; and 1:500 N = 1).

Thirty (43%) of the 89 mule deer (78 females and 11 males) samples tested positive in the MAT (Table I). Twelve (29%) of the 42 samples (39 females and 3 males) from mule deer from Cheyenne County were positive in the MAT. All 12 positive animals were females. The single sample from mule deer (female) from Deuel County was negative in the MAT. Nineteen (41%) of 46 samples (38 females and 8 males) from mule deer from Kimball County were positive in the MAT. Seventeen of the positive mule deer from Kimball County were female and 2 were males. The overall prevalence of antibodies to T. gondii with regard to mule deer sex was 31 (40%) of 78 females and 2 (18%) of 11 males. None of the 29 fetuses examined were positive in the MAT, however the mothers of 15 of these fetuses were positive in the MAT (1:25 N = 2; 1:50 N = 5; 1:100 N = 7; and 1:500 N = 1).

Three (43%) of the 7 white-tailed deer from Deuel County tested positive for T. gondii. All positive white-tailed deer were females and from Keith County were tested. Samples were collected from the fetuses of 5 white-tailed deer and examined using the MAT.

Frozen sera or plasma were sent to the Center for Molecular Medicine and Infectious Diseases, Department of Biomedical Sciences and Pathobiology, Virginia–Maryland Regional College of Veterinary Medicine, Virginia Tech, Blacksburg, Virginia for agglutination testing. The MAT was used to test sera. Controls consisted of sera from experimentally infected mice that were negative for parasites, positive for T. gondii, positive for Neospora caninum, or positive for Sarcocystis neurona. The MAT was used to screen all sera at a 1:25 dilution. Positive sera were further tested at dilutions of 1:50, 1:100, and 1:500.

Table I. Prevalence and agglutinating antibody titers to Toxoplasma gondii in samples from mule deer from Nebraska.

<table>
<thead>
<tr>
<th>County</th>
<th>No. tested/positive</th>
<th>Number positive at dilution of:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1:25</td>
</tr>
<tr>
<td>Cheyenne</td>
<td>42/12</td>
<td>1</td>
</tr>
<tr>
<td>Deuel</td>
<td>1/0</td>
<td>0</td>
</tr>
<tr>
<td>Kimball</td>
<td>46/19</td>
<td>9</td>
</tr>
</tbody>
</table>
the sera tested positive at dilutions of 1:25, 1:50, and 1:100. Three (43%) of the 7 white-tailed deer from Keith County were also positive; they were all females. Their sera were positive at dilutions of 1:25, 1:50, and 1:100. None of the 5 fetuses examined was positive in the MAT; however, the mothers of 2 of these fetuses were positive in the MAT (1:25 and 1:100).

Table II summarizes data on the prevalence of *T. gondii* in mule deer, black-tailed deer, and white-tailed deer from various states in the United States. Chomel et al. (1994) found that only 7% of 274 mule deer from California were positive using the latex agglutination test (LAT) compared to the 35% MAT-positive mule deer observed in the present study. The LAT is not considered to be as sensitive and specific as the MAT (Dubey et al., 1985, 1987; Dubey and Desmonts, 1987) for use in animals. Thus, the study of Chomel et al. (1994) may reflect this and underestimate the prevalence of *T. gondii* in mule deer in California.

Attempts to demonstrate *T. gondii* in mule-deer tissues have been few in number. Dubey (1981) did not isolate *T. gondii* from portions of skeletal muscle from 43 mule deer collected in Montana using mouse bioassay. He later reported (Dubey, 1982) that *T. gondii* was isolated from 2 mule deer from Montana by feeding skeletal muscles to cats. Mule-deer meat, like white-tailed deer meat, should be considered a potential source of *T. gondii*.

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LITERATURE CITED


