Prevalence of Infectious Agents in Free-ranging White-tailed Deer in Northeastern Mexico

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Prevalence of Infectious Agents in Free-ranging White-tailed Deer in Northeastern Mexico

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ABSTRACT: The objectives of this study were to determine the prevalence of antibodies against brucellosis, leptospirosis, infectious bovine rhinotracheitis virus, and bovine viral diarrhea virus (BVDV) in white-tailed deer (Odocoileus virginianus) in northeastern Mexico. Deer (n = 521) were captured from helicopter using a netgun on 15 ranches covering 62,114 ha in the states of Coahuila, Nuevo Leon, and Tamaulipas during spring 2004. The prevalence of antibodies against Leptospira, infectious bovine rhinotracheitis, BVDV, and brucellosis were 5.6, 41.1, 63.5, and 0%, respectively, indicating that white-tailed deer and cattle may share disease agents when cohabiting in northeastern Mexico.

Key words: Bovine viral diarrhea virus (BVDV), brucellosis, infectious bovine rhinotracheitis (IBR), leptospirosis, Odocoileus virginianus, prevalence, white-tailed deer.

Many infectious diseases of domestic animals are shared with wild animals, and transmission from wildlife to livestock, from livestock to wildlife, occasionally transmission to humans can occur (Chomel et al., 1994). There are many potential pathogens that can be shared between white-tailed deer (Odocoileus virginianus) and domestic ruminants, resulting in such diseases as leptospirosis, bovine viral diarrhea virus (BVDV), and infectious bovine rhinotracheitis (IBR). The prevalence of antibodies against Leptospira in deer populations in North America varies between 7% and 27% (Wedman and Driver, 1957; Shotts and Hayes, 1970; Fournier et al., 1986). In Minnesota, USA, a 43% antibody prevalence for Leptospira pomona and L. bratislava in white-tailed deer was reported previously (Goyal et al., 1992). A study of prevalence of Leptospira antibodies in white-tailed deer from Great Smoky Mountains National Park, Tennessee, USA, reported 21% deer seropositive to Leptospira hardjo, L. pomona, and L. icterohaemorrhagiae (New et al., 1993).

Brucellosis is a widespread human, cattle, goat, and swine disease, but it is found rarely in deer in the United States. McCorquodale and DiGiacomo (1985) concluded that wild ungulates have little significance in transmitting brucellosis to cattle in the United States. In northeastern Mexico, 350 white-tailed deer were tested for the prevalence of antibodies against Brucella abortus and Brucella melitensis; no positive animals were detected, suggesting that deer in this area are not important in the epizootiology of brucellosis (Martinez et al., 1999). Surveys of wild ruminants in North America have found a wide range in antibody prevalence estimates for BVDV (Kahrs et al., 1964; Barrett and Chalmers, 1975; Kocan et al., 1986; Aguirre et al., 1995). A type 1a BVDV was isolated from a free-ranging yearling female mule deer (Odocoileus hemionus) from northwestern Wyoming, USA (Van Campen et al., 2001). A noncytopathic BVDV was isolated from white-tailed deer in southeastern South Dakota (USA) in areas with high livestock concentrations (Chase et al., 2004). A study of occurrence of antibodies to infectious bovine rhinotracheitis virus (IBRV, Bovine herpesvirus 1), bovine parainfluenza virus 3 (BPIV-3), Leptospira spp., and B. abortus in white-tailed deer in Minnesota reported prevalences of 15, 20, 3, and 0%, respectively (Inge-
briquetsen et al., 1986). Until now, no serologic studies of these diseases have been conducted in northeastern Mexico on white-tailed deer. The objective of the study was to determine the prevalence of antibodies in white-tailed deer sera against four common transmissible infectious diseases in northeastern Mexico.

This study was conducted on 15 ranches in northeastern Mexico (approximately 26°–28°N, 99°–100°W). We collected 521 blood samples from white-tailed deer during spring 2004. The deer were captured from a helicopter using a netgun in Coahuila, Nuevo Leon, and Tamaulipas states. All work was performed under a scientific collecting permit issued by the Mexican Division Animal Health Wildlife. Bleeding was done by jugular venipuncture using vacuum tubes without anticoagulant. The samples were allowed to clot, then they were centrifuged. Finally, sera were collected and stored at 4°C until arrival at the laboratory, where the sera were stored at −20°C until tested.

The microscopic-agglutination test (Faine, 1982) was used to detect antibodies to nine serovars of L. interrogans: icterohamaemorrhagiae, hardjo, pyrogens, grippotyphosa, canicola, pomona, wolffi, bratislava, and tarssovi. A titer of ≥100 was regarded as positive. An enzyme-linked immunosorbent assay test/kit for IBRV and BVDV antibody detection (Cypress Diagnostics C.V. 2002 Ref. HLS, Veterinary Biological Products, Inc., Port Byron, Illinois 61275, USA [VB021]). Sera were tested for antibodies to B. abortus using the Rose Bengal test. Chi-square and logistic regression analyses were performed using STATA software, version 9.0 (Stata Corporation LP, College Station, Texas, USA) to measure the strength of association between antibody prevalence and management factors and to obtain odds ratios at 95% confidence intervals.

Of 521 white-tailed deer serum samples tested, 214 (41%) had antibodies against IBRV. The highest IBRV antibody prevalence was found in Nuevo Laredo, Tamaulipas municipality (61%), followed by Guerrero, Coahuila (58%). Twenty-nine (5.5%) of the samples had antibodies to L. interrogans; however, the antibody prevalence was low at all locations, ranging from 0% in Guerrero, Tamaulipas to 25% in Hidalgo, Coahuila. Three hundred thirty-one samples (64%) were antibody positive to BVDV, and the prevalence was high at all locations, ranging from 11% in Nuevo Laredo, Tamaulipas to 100% in Hidalgo, Coahuila. Antibodies to B. abortus were not detected. Of the 15 deer populations (herds) tested, seropositive animals for BVDV, L. interrogans, and IBRV were detected in 15 (100%), nine (60%), and 15 (100%) of herds, respectively (Table 1).

The results of chi-square (P<0.01) analyses indicate antibody prevalence to IBRV was higher on ranches with high fences (45%) and on ranches using rotational grazing systems (48%). Ranches that had high densities of deer (one deer/10 ha) also had a higher prevalence (51%) of IBRV antibody-positive deer than ranches with low deer density (one deer/5 ha); however, BVDV antibody prevalence was highest on ranches with low deer density (70%). Ranches with both cattle and deer had higher prevalence (66%) of BVDV antibody-positive deer than ranches where cattle were absent. Deer on ranches where brush and exotic grasses were abundant also had higher antibody prevalence estimates for both IBR and BVDV (Table 2).

The most common studies of leptospirosis in white-tailed deer have been serologic surveys. The earliest surveys were conducted in the late 1950s and 1960s. Antibodies to serovars L. grippotyphosa and L. pomona are commonly reported in white-tailed deer (Shotts, 1981). Serovar L. hardjo is strongly associated with cattle (Hanson, 1982). In Tamaulipas, Mexico, serovar hardjo has been diagnosed in cattle, with prevalences ranging from 40% to 68% (Cantu and Alvarado, 1999). In Tennessee, New et al. (1993) studied sympatric white-tailed deer
and cattle and observed that antibodies to *L. interrogans* in 106 seropositive deer (11%) had titer to *L. hardjo*. Our results show 29 (5.6%) seropositive white-tailed deer had a titer of 1:100 to *L. hardjo*; this is less than reported by New et al. (1993). Haugen (1967) reported finding serovar *L. hardjo* titers in 1.1% of 369 deer sera collected in Iowa, USA. Goyal et al. (1992) found 43% of deer seropositive at ≥1:100 for serovars *L. pomona* and *L. bratislava*, whereas none are positive for serovar *L. hardjo*. The results provide evidence of exposure of white-tailed deer to the same

<table>
<thead>
<tr>
<th>Municipality</th>
<th>State</th>
<th>n</th>
<th>Brucellosis</th>
<th>IBRV</th>
<th>Leptospirosis</th>
<th>BVDV</th>
</tr>
</thead>
<tbody>
<tr>
<td>N. Laredo</td>
<td>Tamp.</td>
<td>32a</td>
<td>0/0b</td>
<td>16/50.0</td>
<td>1/3.1</td>
<td>14/43.7</td>
</tr>
<tr>
<td>N. Laredo</td>
<td>Tamp.</td>
<td>34</td>
<td>0/0</td>
<td>21/61.7</td>
<td>0/0</td>
<td>25/82.4</td>
</tr>
<tr>
<td>N. Laredo</td>
<td>Tamp.</td>
<td>9</td>
<td>0/0</td>
<td>5/55.5</td>
<td>1/11.1</td>
<td>1/11.1</td>
</tr>
<tr>
<td>Guerrero</td>
<td>Tamp.</td>
<td>87</td>
<td>0/0</td>
<td>12/13.8</td>
<td>0/0</td>
<td>71/81.6</td>
</tr>
<tr>
<td>Hidalgo</td>
<td>Coah.</td>
<td>9</td>
<td>0/0</td>
<td>2/22.2</td>
<td>0/0</td>
<td>9/100.0</td>
</tr>
<tr>
<td>Hidalgo</td>
<td>Coah.</td>
<td>26</td>
<td>0/0</td>
<td>12/46.1</td>
<td>4/15.3</td>
<td>11/42.3</td>
</tr>
<tr>
<td>Hidalgo</td>
<td>Coah.</td>
<td>20</td>
<td>0/0</td>
<td>10/50.0</td>
<td>5/25.0</td>
<td>8/40.0</td>
</tr>
<tr>
<td>Hidalgo</td>
<td>Coah.</td>
<td>58</td>
<td>0/0</td>
<td>29/50.0</td>
<td>1/1.7</td>
<td>33/56.8</td>
</tr>
<tr>
<td>Guerrero</td>
<td>Coah.</td>
<td>22</td>
<td>0/0</td>
<td>11/50.0</td>
<td>0/0</td>
<td>18/81.8</td>
</tr>
<tr>
<td>Guerrero</td>
<td>Coah.</td>
<td>49</td>
<td>0/0</td>
<td>25/51.0</td>
<td>0/0</td>
<td>39/79.6</td>
</tr>
<tr>
<td>Guerrero</td>
<td>Coah.</td>
<td>29</td>
<td>0/0</td>
<td>17/58.6</td>
<td>3/11.1</td>
<td>5/17.2</td>
</tr>
<tr>
<td>Guerrero</td>
<td>Coah.</td>
<td>48</td>
<td>0/0</td>
<td>15/31.2</td>
<td>5/10.6</td>
<td>41/85.2</td>
</tr>
<tr>
<td>Guerrero</td>
<td>Coah.</td>
<td>65</td>
<td>0/0</td>
<td>29/44.6</td>
<td>7/10.9</td>
<td>27/41.5</td>
</tr>
<tr>
<td>Anahuac N.L.</td>
<td>15</td>
<td>0/0</td>
<td>6/40.0</td>
<td>2/13.3</td>
<td>12/80.0</td>
<td>14/77.7</td>
</tr>
<tr>
<td>Anahuac N.L.</td>
<td>18</td>
<td>0/0</td>
<td>4/22.2</td>
<td>0/0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total %</td>
<td></td>
<td>521</td>
<td>214/41.07</td>
<td>28/5.56</td>
<td>331/63.53</td>
<td></td>
</tr>
</tbody>
</table>

a Tamp. = Tamaulipas; Coah. = Coahuila; N.L. = Nuevo Leon.

b Number tested.

c Number positives/percentage.

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and cattle and observed that antibodies to *L. interrogans* in 106 seropositive deer (11%) had titer to *L. hardjo*. Our results show 29 (5.6%) seropositive white-tailed deer had a titer of 1:100 to *L. hardjo*; this is less than reported by New et al. (1993). Haugen (1967) reported finding serovar *L. hardjo* titers in 1.1% of 369 deer sera collected in Iowa, USA. Goyal et al. (1992) found 43% of deer seropositive at ≥1:100 for serovars *L. pomona* and *L. bratislava*, whereas none are positive for serovar *L. hardjo*. The results provide evidence of exposure of white-tailed deer to the same

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Leptospira</th>
<th>IBRV</th>
<th>BVDV</th>
</tr>
</thead>
<tbody>
<tr>
<td>High fence</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>3.3</td>
<td>27.5</td>
<td>63.3</td>
</tr>
<tr>
<td>Yes</td>
<td>3.9</td>
<td>0.34</td>
<td>45.5</td>
</tr>
<tr>
<td>Deer density</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1/10 ha</td>
<td>5.9</td>
<td>51.8</td>
<td>53.3</td>
</tr>
<tr>
<td>1/15 ha</td>
<td>9.3</td>
<td>0.73</td>
<td>29.3</td>
</tr>
<tr>
<td>Grazing system</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Continuous</td>
<td>6.3</td>
<td>29.2</td>
<td>64.8</td>
</tr>
<tr>
<td>Rotation</td>
<td>5.0</td>
<td>0.52</td>
<td>48.8</td>
</tr>
<tr>
<td>Activity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cattle/deer</td>
<td>4.8</td>
<td>41.6</td>
<td>66.6</td>
</tr>
<tr>
<td>Deer</td>
<td>9.3</td>
<td>0.09</td>
<td>38.3</td>
</tr>
<tr>
<td>Habitat</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brush</td>
<td>3.8</td>
<td>31.4</td>
<td>62.5</td>
</tr>
<tr>
<td>Brush/exotic grass</td>
<td>4.7</td>
<td>0.05</td>
<td>45.8</td>
</tr>
<tr>
<td>Brush/native grass</td>
<td>9.9</td>
<td>52.8</td>
<td>52.8</td>
</tr>
</tbody>
</table>
serovar that infects cattle and that this is
the predominant serovar infecting deer in
northeastern Mexico. The relatively low
prevalence of antibodies across all areas in
this study is similar to the 7% reported by
Fournier et al. (1986) in Ohio, USA. Based
on our study, leptospirosis does not seem
to be a problem for deer in three
northeastern states of Mexico. Only the
type of grazing system had a significant
strength of association between seroposi-
tive deer and leptospirosis; deer were 3.6
times more likely to be positive when they
coeexisted with cattle under continuous
grazing rather than on rotational grazing
systems. This may due to the use of the
same range by cattle and deer and the
persistent contamination of the grass and
water sources used by both species.

No antibodies to B. abortus were detect-
ed in our study; similar negative results have
been reported for 37 white-tailed deer from
Texas (Boeer, 1980), white-tailed deer from
six ranches in the northeastern Mexico
(Martínez et al., 1999), and from deer
sampled in Minnesota (Ingebretsen et al.,
1986). These negative results may in part
relate to B. abortus control measures; at
present, the prevalence of brucellosis in
cattle in this area is <0.5%.

Experimentally, cervids are susceptible
to infection with noncytopathic BVDV;
they can become viremic, shed virus for a
short time through nasal secretions, and
seroconvert. However, deer seldom devel-
op clinical disease (Van Campen et al.,
1997). Contact between livestock and
wildlife in Minnesota was suggested as
an explanation for the prevalence of antibody
positive white-tailed deer for
BVDV (19–54%) and IBRV (15%; Inge-
brigsten et al., 1986). Our antibody
prevalence estimate was slightly higher
for BVDV (63%) and much higher for
IBRV (41%). These higher antibody
prevalence estimates may relate to manage-
ment and the prevalence of these diseases
in cattle. Antibody prevalence estimates in
our study were highest on ranches where
dereer cohabited with cattle and on ranches
where brush and exotic grasses were
abundant. In addition, continuous grazing
increased the risk for deer testing sero-
positive to BVDV. These factors possibly
reflect increased contact, and increased
animal densities. With regard to these
diseases in cattle, in Tamaulipas, Mexico,
IBR and BVDV have been diagnosed in
cattle with prevalences of 38 and 55%,
respectively (Cantu and Alvarado, 1999).

The seropositive samples detected in
our study indicate that cattle and white-
tailed deer are exposed to common
pathogens. The high prevalences of anti-
bodies to BVDV and IBR in deer indicate
that many deer survive these infections;
however, it is not clear whether these
animals represent an important reservoir
to cattle or whether they are persistently
infected and are capable of shedding virus
throughout their life.

Based on our serologic evidence, the
serovar L. hardjo is the predominant
Leptospira serovar infecting deer in north-
eastern Mexico. However, it is unknown
whether these infections adversely affect
dereer health. Likewise, the potential im-
fluences of BVDV infections on deer health
are difficult to determine. An important
question may relate to the potential for
BVDV to cause reproductive problems in
dereer, and this question deserves further
investigation. Additionally, additional re-
search is needed to develop management
strategies for disease control and preven-
tion strategies that recognize that impor-
tant pathogens can and will be shared
between wildlife and domestic animal
species that use the same habitats.

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LITERATURE CITED


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