Brucellosis in adult beef cattle of Mexican origin shipped direct-to-slaughter into Texas

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Objective—To compare prevalence estimates of brucellosis (BR) in adult beef cattle that originated from different states and regions of Mexico and that were shipped direct-to-slaughter into Texas during 1995.

Design—Epidemiologic survey.

Animals—About 65,000 adult beef cattle.

Procedure—Blood samples were collected during postmortem examinations and were tested for serum antibodies to Brucella abortus, using the particle concentration fluorescence immunoassay and automated complement-fixation test. Prevalence estimates and 95% confidence intervals of BR were calculated by state of origin in Mexico. The difference among prevalence estimates of BR in cattle from different states and regions was tested for significance ($P<0.05$), using the proportion test.

Results—On the basis of serologic test results, the overall prevalence estimate of BR was 0.32%. The prevalence estimate of BR in cattle from the state of Chihuahua (0.10%) was significantly different than that in cattle from the states of Nuevo Leon (0.23%), Zacatecas (0.34%), Durango (0.47%), Chiapas (1.81%), Tamaulipas (2.71%), Aguascalientes (7.89%), and Campeche (12.24%). In addition, prevalence estimates of BR in cattle were significantly different among the northern (0.22%), south-central (3.18%), and south coastal (9.42%) regions of Mexico.

Clinical Implications—Results of this study indicate that the number of cattle exposed to B abortus may be significantly different among states and regions of Mexico. Current import sanitary requirements should continue to mitigate potential risk of transmission of BR from sexually intact cattle of Mexican origin to Texas cattle. (J Am Vet Med Assoc 1998;212:705–707)

Brucellosis (BR) in cattle is a disease of paramount importance to the livestock industry and animal health authorities in Texas. The Cooperative State-Federal Brucellosis Eradication Program in Texas is supported by regulatory infrastructure, animal health services (prevention, control, diagnosis, and surveillance), and indemnity funds to eradicate the disease. Texas achieved class “A” BR status in 1994 and now is approaching eradication status.1 In the United States, one of the requirements for class “A” status is that the herd infection rate caused by a field strain of Brucella abortus may not exceed 2.5 herd/1,000 herds. During the 1996 fiscal year, 209 cattle herds were under quarantine in 16 US states; of the 209 herds, 121 (58%) were beef herds in Texas under quarantine because of BR.2

Brucellosis is recognized as one of the most important zoonotic diseases in Mexico because of the economic and public health implications.3 4 In 1993, Mexico established a national commission for control and eradication of tuberculosis (TB) and BR in cattle.4 The commission adopted a national animal identification system, using a blue metal ear tag (with a numeric code to identify state of origin) for cattle exported to the United States. To increase its efforts to control and eradicate these 2 diseases, the commission hired more than 200 veterinarians and established 8 regional laboratories with the capability of conducting serologic and bacteriologic testing for diagnoses of BR and TB.5 The Mexican BR program recommends use of the B abortus strain 19 vaccine for immunizing cattle against BR.6 Vaccination methods are similar to those previously used in the United States. In Mexico, a standard dose of strain 19 ($5 \times 10^{10}$ viable organisms/5 ml of vaccine) is administered subcutaneously to heifers between 3 and 6 months old.7 Strain 19 is also used in reduced doses ($3 \times 10^{7}$ to $3 \times 10^{6}$ viable organisms/2 ml of vaccine). Reduced doses are recommended for use in heifers more than 6 months old and for pregnant cattle.

In the United States, Texas is the primary export market for cattle from Mexico. During the 1995 and 1996 fiscal year, 1,653,050 cattle were imported from Texas from Mexico.8 Most (94%) imported cattle were steers, and about half went initially to pasture for about 150 days before entering a feedlot. A smaller number (16,680; 1%) were sexually intact cattle that originated from breeding herds in Mexico.

Results of studies9 10 conducted in different regions of Mexico have reported different prevalence estimates of BR in cattle. Between 1982 and 1983 in a study conducted in the northern states of Coahuila, Nuevo Leon, and Tamaulipas, 35% of 40 herds were found to have at least 1 animal that was seropositive for B abortus; of 2,070 tested cattle, 30 (2.4%) were classified as seropositive.9 Between 1983 and 1984 in the coastal region of Baja California, Mexico, 67% of 103 dairy herds were found to have at least 1 animal that was seropositive for B abortus; of 8,265 tested cattle, 1,157 (14.3%) were seropositive.9

In 1995, in the interest of the United States and Mexico, a binational committee (consisting of industry, research, and regulatory representatives from Mexico and the United States) included BR in its scope along with TB. The binational committee oversees TB and BR program performance in Mexican states with interest in exportation of cattle to the United States.10

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In 1995, climatic (drought) and market conditions in Texas and Mexico influenced culling and the international movement northward of adult beef cattle. During that year, 65,233 adult (>2 years old) beef cattle were shipped direct-to-slaughter from 12 Mexican states into Texas. At slaughter, use of blue metal cartags allowed for identification and detection of cattle from Mexico that were exposed to Brucella sp. Using serologic testing, the objective of the study reported here was to compare prevalence estimates of BR in cattle that originated from different states and regions of Mexico and that were shipped direct-to-slaughter into Texas during 1995.

Materials and Methods

Data on cattle imported from Mexico were gathered, using USDA-Veterinary Services forms 17-30 and 17-33.6 Blood samples were collected from 65,233 cattle of Mexican origin during postmortem examinations at Texas slaughter plants. Samples were shipped to the State-Federal Laboratory in Austin, Tex, for serologic testing for antibodies to B abortus. In the laboratory, blood samples were allowed to clot and then were centrifuged to obtain serum. Serum was decanted and frozen until tested. Particle concentration fluorescence immunoassay (PCFIA) and the automated complement-fixation test were used for each serum sample.6 Cattle with PCFIA6 ratios <0.5 or complement-fixation antibody titers ≥1.5 were classified as previously exposed to B abortus. The PCFIA results may be expressed as a ratio by dividing photon counts of the test sample by average counts of the negative control sample. This ratio ranges from approximately 1.0 for negative results to approximately 0.15 for strongly positive results.

Data analysis—Prevalence estimates and 95% confidence intervals for BR were calculated in cattle populations that originated from 12 different states in Mexico.6 Differences among prevalence estimates of BR in cattle from different states and regions were tested for significance (P < 0.05), using the proportion test.6

Results

Most cattle (55,556; 85%) shipped direct-to-slaughter into Texas originated from the following 3 northern border states of Mexico: Chihuahua, Coahuila, and Nuevo Leon (Fig 1). The state of Chihuahua exported the most cattle (27,576; 42%). The overall prevalence of seropositive cattle to B abortus was 0.32% (Table 1). Prevalence estimates of BR in cattle from Chihuahua (0.10%) were significantly different than that in cattle from the states of Nuevo Leon (0.23%), Zacatecas (0.34%), Durango (0.47%), Chiapas (1.81%), Tamaulipas (2.71%), Aguascalientes (7.89%), and Campeche (12.24%). In addition, prevalence estimates of BR in cattle were significantly different among the northern (0.22%), south-central (3.18%), and south coastal (9.42%) regions of Mexico (Table 2).

Discussion

In this study, we measured exposure of cattle to Brucella organisms and attempts were not made to isolate the microorganism. Use of serologic methods alone has some limitations, because cross-reactions with other nonspecific microorganisms may lead to confusion in interpretation of serologic results.7,11 Further, care should be taken in interpretation of serologic results because herd seroprevalence and cattle vaccination status could not be determined; prevalence esti-

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**Table 1**—Prevalence estimates of brucellosis (BR) in cattle that originated from different states of Mexico and were shipped direct-to-slaughter into Texas

<table>
<thead>
<tr>
<th>State</th>
<th>No. of inspected cattle</th>
<th>No. of seropositive cattle</th>
<th>Prevalence estimate (%)</th>
<th>95% confidence interval (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Veracruz</td>
<td>94</td>
<td>0</td>
<td>0</td>
<td>NA</td>
</tr>
<tr>
<td>La Laguna</td>
<td>534</td>
<td>0</td>
<td>0</td>
<td>NA</td>
</tr>
<tr>
<td>Chihuahua*</td>
<td>27,576</td>
<td>30</td>
<td>0.106,b</td>
<td>0.07-0.15</td>
</tr>
<tr>
<td>Coahuila</td>
<td>18,562</td>
<td>30</td>
<td>0.16a,b</td>
<td>0.10-0.23</td>
</tr>
<tr>
<td>Nuevo Leon*</td>
<td>9,418</td>
<td>22</td>
<td>0.23b</td>
<td>0.14-0.35</td>
</tr>
<tr>
<td>Zacatecas</td>
<td>1,437</td>
<td>5</td>
<td>0.54c</td>
<td>0.11-0.91</td>
</tr>
<tr>
<td>Durango</td>
<td>5,298</td>
<td>25</td>
<td>0.47d</td>
<td>0.35-0.70</td>
</tr>
<tr>
<td>San Luis Potosi</td>
<td>332</td>
<td>2</td>
<td>0.060b,c,d</td>
<td>0.07-2.15</td>
</tr>
<tr>
<td>Hidalgo</td>
<td>162</td>
<td>1</td>
<td>0.61a,b,c,d</td>
<td>0.00-3.39</td>
</tr>
<tr>
<td>Chiapas</td>
<td>164</td>
<td>3</td>
<td>1.82a,c,d</td>
<td>0.37-5.25</td>
</tr>
<tr>
<td>Tamaulipas*</td>
<td>1,103</td>
<td>30</td>
<td>2.71b</td>
<td>1.84-3.86</td>
</tr>
<tr>
<td>Aguascalientes</td>
<td>152</td>
<td>12</td>
<td>7.89f</td>
<td>4.14-13.38</td>
</tr>
<tr>
<td>Campeche</td>
<td>441</td>
<td>54</td>
<td>12.24f</td>
<td>9.33-15.67</td>
</tr>
<tr>
<td>Total</td>
<td>65,233</td>
<td>214</td>
<td>0.32</td>
<td>0.28-0.37</td>
</tr>
</tbody>
</table>

*Texas-Mexico border state.

**Table 2**—Prevalence estimates of BR in cattle that originated from different regions of Mexico and were shipped direct-to-slaughter into Texas

<table>
<thead>
<tr>
<th>Region*</th>
<th>No. of inspected cattle</th>
<th>No. of seropositive cattle</th>
<th>Prevalence estimates (%)</th>
<th>95% confidence interval (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>North</td>
<td>64,220</td>
<td>144</td>
<td>0.22a</td>
<td>0.18-0.26</td>
</tr>
<tr>
<td>South-central</td>
<td>408</td>
<td>13</td>
<td>3.16b</td>
<td>1.70-5.38</td>
</tr>
<tr>
<td>South coastal</td>
<td>605</td>
<td>57</td>
<td>9.42c</td>
<td>7.21-12.03</td>
</tr>
<tr>
<td>Total</td>
<td>65,233</td>
<td>214</td>
<td>0.32</td>
<td>0.28-0.37</td>
</tr>
</tbody>
</table>


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Footnotes:
6 Texas-Mexico border state.

Figure 1—Geographic location of Mexican states that exported adult beef cattle into Texas in 1995. Chh = Chihuahua; Coah = Coahuila; NL = Nuevo Leon; Tam = Tamaulipas; SLP = San Luis Potosi; Ver = Veracruz; Cmp = Campeche; Chis = Chiapas; Hlg = Hidalgo; Ags = Aguascalientes; Zct = Zacatecas; and Drg = Durango. Dotted-line area between Coahuila and Durango indicates La Laguna.
mates of BR were made on the basis of one-time test results, rather than testing during different time intervals. However, results are useful because they provide information of epidemiologic interest about exposure to *B. abortus* in the imported cattle of this report. A sample size of about 3,000 tested cattle/state would ensure with 95% confidence that at least 1 infected animal would be detected if the disease was present at a prevalence of ≥ 0.1% (assuming a reference population of more than 10,000 cattle). A sufficient sample size was not obtained for detection of at least 1 infected animal in the state of Veracruz or in the area of La Laguna.

In this study, prevalence estimates of BR in adult beef cattle to *B. abortus* were significantly different among states and regions in Mexico. In the northern region, cattle from Tamaulipas seemed to be at a higher risk of *B. abortus* exposure, compared with cattle from Chihuahua, Coahuila, Nuevo Leon, Zacatecas, Durango, and San Luis Potosi. Furthermore, cattle that originated from the southern states appeared to be at higher risk of exposure to *B. abortus*, compared with cattle from the northern states. These results are in agreement with results of a previously documented analysis of BR in Mexico: incidence of the disease is higher in geographic areas with high stocking density, such as the south-central and south coastal regions of Mexico. Epidemiologic studies have proven to be useful in exploring the relative importance of risk factors (ie, stocking density, breed distribution, husbandry and management practices, trade, and veterinary services) known to be associated with the frequency and distribution of BR in cattle in different geographic regions.

Currently, the potential risk that may be presented by sexually intact cattle of Mexican origin to Texas stock cattle is mitigated by enforcement of import sanitary requirements. In Texas, import requirements for sexually intact cattle from countries without a comparable BR status include the following: bulls and sexually intact female cattle (entering Texas for purposes other than immediate slaughter or feeding) must originate from BR-free herds and be tested for BR at the port of entry into Texas; cattle must be placed under quarantine and retested for BR in 120 to 180 days for release of the quarantine; in pregnant heifers, negative test results for release of the quarantine shall not be sooner than 30 days after calving; and nonvaccinated heifers from 4 to 10 months old shall be placed under quarantine and be vaccinated within 14 days.

Mexican states or regions with interest in the exportation of breeding cattle to Texas should continue working toward eradication of BR in cattle. For instance, on the basis of current state regulations in Texas, sexually intact cattle from class "C" states or areas shall originate from a certified BR-free herd when consigned for purposes other than slaughter or quarantined feedlot or designated pen (heifers > 4 months old must meet vaccination requirements for entry). In the United States, areas with class "C" status were supported by regulatory infrastructure, animal health services (prevention, control, diagnosis, and surveillance), and indemnity funds to eradicate the disease. In these areas, herd infection rate caused by a field strain *B. abortus* exceeded 16 herds/1,000 herds.

Results of this study indicate that exposure of adult beef cattle to *B. abortus* may be significantly different among states and regions of Mexico. The Mexican BR program is not supported by indemnity funds. Consequently, the success of BR control and eradication efforts depends largely on the efficacy and efficiency of the cattle industry, regulatory infrastructure, and veterinary services. Continuation of current import sanitary requirements to mitigate potential risk of BR transmission from sexually intact cattle of Mexican origin to Texas breeding stock is recommended. The binational committee should continue playing a cooperative role in the training and sharing of expertise on subjects related to control and eradication of BR in Mexican states that request technical assistance.

1. USDA, APHIS, VS, Laredo, Tex.
2. IDEXX Laboratories Inc., Westbrook, Maine.

References