Effect of reactor retention on the spread of brucellosis in Jersey cattle and buffalo herds

S. AKHTAR *, M. AFZAL *, S. ALI * and M.I. KHAN **

Summary: The rate of spread of bovine brucellosis was investigated in buffalo and Jersey cattle herds maintained at a Livestock Research station in Pakistan. Reactor animals (identified by conventional serological tests) were either retained or culled because of advanced age or poor productivity. Reactors were housed, managed and fed separately from the rest of the herds.

The initial seroprevalence of brucellosis among both the Jersey cattle and the buffalo tested was 21.4%, the difference being statistically insignificant (p = 0.218). For 34 months, the spread of brucellosis was limited to 25 new reactors in the 334 cows and 33 in the 442 buffaloes. The mean attack rate was 7.5% for both herds during the test intervals. Trend analysis of proportions positive at each testing revealed a significant decrease in the percentages observed at the first testing. The management practice of segregation offered some advantage in reducing the spread of brucellosis to negative animals. However, an epidemiological study covering a large number of herds would be required to identify risk factors responsible for perpetuating the disease.

KEYWORDS: Brucella abortus - Brucellosis - Buffalo - Cattle - Epidemiology.

INTRODUCTION

Bovine brucellosis is endemic in Pakistan. The serological prevalence of the disease among government herds in selected areas has been given as 14.3% in cattle and 26.5% in buffaloes. Corresponding figures for private herds were 2.4% and 3.3%, respectively (1, 5). At present, no officially-approved brucellosis control and eradication programme is being implemented in the country; therefore, no mandatory measures have been adopted to curtail the spread of the disease in government and private herds. Vaccination against brucellosis is not carried out, since no locally prepared vaccine against brucellosis is available.

Owing to the high prices of cattle and buffalo, the test-and-slaughter method is not a pragmatic approach to the eradication of bovine brucellosis in Pakistan. Furthermore, if such a method were followed, official herd sizes would be difficult to maintain due to the paucity of pedigree animals. Testing, isolation and separate

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management of reactors is the only viable option to limit the spread of brucellosis in official and large private herds. However, the impact of such a policy in Pakistan has yet to be demonstrated.

The present study reports the rate of spread of brucellosis in research herds of Jersey cattle and buffalo, when the reactors were retained or removed after each serological testing.

**MATERIALS AND METHODS**

**Description of the herds**

A herd of 50 pregnant Jersey cows, certified free from brucellosis, was imported from the USA in February 1985. A herd of about 130 buffaloes of the Nili-Ravi breed was kept at the Livestock Research Station (LRS) of the Animal Sciences Institute in Islamabad. The buffalo herd was serologically negative for brucellosis when tested in the summer of 1984. However, a point prevalence of 1.5% was found in a herd of 168 Australian Illawara Shorthorn (AIS) cows kept on the same premises (6). The whole AIS herd was culled from the LRS before arrival of the Jersey herd, due to a change in the breeding policy of the Institute.

**Herd health management**

Animals in both cattle and buffalo herds were identified by ear tags, vaccinated regularly against foot and mouth disease and haemorrhagic septicaemia, monitored both for endo- and ecto-parasites and treated accordingly when needed. Because local Jersey replacements were not available, cow replacements came only from heifers retained in the herd. Buffalo replacements were also generally reared from calves born on the farm, although some replacements were purchased from the home tract of the Nili-Ravi buffalo breed and quarantined for at least 4 weeks upon arrival.

**Brucellosis testing**

Brucellosis testing commenced in January 1987, when the number of abortions in 1986 exceeded the endemic level (Fig. 1). Serum samples from all the animals were initially screened with the card agglutination test. The serum agglutination test was used as a confirmatory test on serum samples from the animals identified as reactors by the card test (2). Reactors in both herds were identified but not removed from the herds; they were, however, housed, managed and fed separately, immediately after being identified. This management plan was rigorously followed at the LRS during the present study. Cattle and buffalo were culled for slaughter if they were of advanced age and poor productive and reproductive efficiency. Reactors present in the herds when the study began were classified as original reactors. Initially negative animals which became seropositive at subsequent testing were classified as new reactors. For various reasons, the test intervals were not constant.

**Statistical analysis**

The initial prevalence in the cattle and buffalo herds was compared by chi-square analysis (4). Attack rates for subsequent testing were computed and trend analysis of the proportions of reactors in pooled data for cattle and buffalo herds was carried out (10).
RESULTS

Test dates, the number of animals tested, initial prevalence and attack rates for both herds are presented in Tables I and II.

### Table I

**Summary of brucellosis testing of the Jersey cattle herd at the Livestock Research Station**

<table>
<thead>
<tr>
<th>Test dates</th>
<th>Cows tested</th>
<th>Negative</th>
<th>OR&lt;sup&gt;a&lt;/sup&gt;</th>
<th>NR&lt;sup&gt;b&lt;/sup&gt; (5)</th>
<th>NR (9)</th>
<th>NR (6)</th>
<th>NR (9)</th>
<th>Initial prevalence (%)</th>
<th>Attack rates (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/87</td>
<td>70</td>
<td>55</td>
<td>15</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6/87</td>
<td>85 (70)&lt;sup&gt;c&lt;/sup&gt;</td>
<td>63</td>
<td>15</td>
<td>7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5/88</td>
<td>152 (132)</td>
<td>127</td>
<td>20&lt;sup&gt;d&lt;/sup&gt;</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12/88</td>
<td>86 (73)</td>
<td>64</td>
<td>13&lt;sup&gt;d&lt;/sup&gt;</td>
<td></td>
<td>9</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10/89</td>
<td>59 (59)</td>
<td>55</td>
<td></td>
<td></td>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<sup>a</sup> OR = Original reactors  
<sup>b</sup> NR = New reactors (test intervals in months)  
<sup>c</sup> Number of known negatives at the start of current testing  
<sup>d</sup> Known positives remaining from previous testing

The initial serological prevalence was 21.4% in the cattle herd and 26.1% in the buffalo herd (a statistically insignificant difference at p = 0.218). Despite the very high initial prevalence in both herds, the spread of the disease during 34 months among 334 cows and 442 buffaloes tested was limited to 25 and 33 new reactors, respectively. The trends in attack rates at various test intervals are depicted in Fig. 2. The mean attack rate was 7.5% for both cattle and buffalo herds. Apart from the substantial difference at the second testing, the percentage of reactors in both herds followed almost the same pattern over the entire period.

### Table II

**Summary of brucellosis testing of the buffalo herd at the Livestock Research Station**

<table>
<thead>
<tr>
<th>Test dates</th>
<th>Cows tested</th>
<th>Negative</th>
<th>OR&lt;sup&gt;a&lt;/sup&gt;</th>
<th>NR&lt;sup&gt;b&lt;/sup&gt; (5)</th>
<th>NR (9)</th>
<th>NR (6)</th>
<th>NR (9)</th>
<th>Initial prevalence (%)</th>
<th>Attack rates (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/87</td>
<td>115</td>
<td>85</td>
<td>30</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6/87</td>
<td>99 (85)&lt;sup&gt;c&lt;/sup&gt;</td>
<td>80</td>
<td>14</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5/88</td>
<td>119 (116)</td>
<td>111</td>
<td>3&lt;sup&gt;d&lt;/sup&gt;</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12/88</td>
<td>86 (73)</td>
<td>108</td>
<td>1&lt;sup&gt;d&lt;/sup&gt;</td>
<td></td>
<td>15</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10/89</td>
<td>59 (59)</td>
<td>108</td>
<td>2&lt;sup&gt;d&lt;/sup&gt;</td>
<td></td>
<td>8</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<sup>a</sup> OR = Original reactors  
<sup>b</sup> NR = New reactors (test intervals in months)  
<sup>c</sup> Number of known negatives at the start of current testing  
<sup>d</sup> Known positives remaining from previous testing
Annual incidence rate of abortion in buffalo and Jersey cattle herds at the Livestock Research Station — 1985-1989

Initial prevalence and attack rates of brucellosis in buffalo and Jersey cattle herds at the Livestock Research Station
Trend analysis of the proportions of seropositive animals in pooled data (Table III) for cattle and buffalo revealed a significant decrease from the situation observed at the first test (trend coefficient = \(-0.053\); \(p < 0.001\)).

<table>
<thead>
<tr>
<th>TABLE III</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Initial incidence and attack rates of brucellosis on different testing</strong></td>
</tr>
<tr>
<td>(pooled data on Jersey cattle and buffalo herds)</td>
</tr>
<tr>
<td>Test dates</td>
</tr>
<tr>
<td>Negative</td>
</tr>
<tr>
<td>Positive</td>
</tr>
<tr>
<td>Total</td>
</tr>
<tr>
<td>Proportion* seropositive</td>
</tr>
</tbody>
</table>

* Proportions differ significantly (trend coefficient = \(-0.053\); \(p < 0.001\))

**DISCUSSION**

The value of vaccination in controlling brucellosis is well-known. However, it has also been demonstrated that vaccine alone will not eliminate infection (7). Epidemiological data are necessary for developing an effective control plan for actually or possibly infected herds. The effects of vaccination and changes in herd management must be taken into account when planning a brucellosis control programme (8, 11).

In the present study, the initial testing revealed an epidemic state since the seroprevalence was much higher than that of the previous record at the LRS. A disease level above the endemic level constitutes an epidemic (10). No vaccination was carried out because there is no official vaccination programme against brucellosis. Furthermore, no vaccine against brucellosis is prepared locally or officially imported. A test-and-slaughter policy during the current epidemic at the LRS would have placed an unnecessary burden on the government budget in order to maintain the herd size needed for the research centre. Therefore, retention of reactor animals was the only economically viable option for the Institute. Further support for this option was the fact that reactors generally remain reproductively active, because brucellosis rarely affects conception and normally causes abortion only in first-calf heifers or newly-introduced susceptible animals. Subsequent pregnancies in brucella-infected cows seldom terminate in abortions (3, 9).

Despite the limitations mentioned above, rigorous application of the present management practices did offer some advantage in curtailing the spread of brucellosis to disease-free animals. It allowed for continued calf production from reactor animals and eliminated the necessity to import more Jersey cattle to maintain herd size, thus avoiding further expenditure. Such a management policy has been advocated by others (11). Similar plans, if strictly applied, could also be effective in organised official and large private herds having a small proportion of infected, but reproductively active, animals. Further studies would be required to understand the epidemiology
of brucellosis in Pakistan. Such an effort would support control by providing information on host and managerial factors which help to perpetuate the disease among the bovine population.

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Résumé : Le taux de propagation de la brucellose bovine a été étudié dans des troupeaux de buffles et de bovins de race jersiaise, dans un centre pakistanais de recherche sur le bétail. Les animaux séropositifs (identifiés par les tests sérologiques classiques) ont été séquestrés ; ceux qui étaient trop âgés ou peu productifs ont été abattus. Les animaux séropositifs ont été mis en stabulation, traités et nourris séparément des autres.

La prévalence des cas séropositifs pour la brucellose parmi les bovins de race jersiaise et les buffles testés était initialement de 21,4 %, la différence n’ayant pas été statistiquement significative (p = 0,218). En 34 mois, la brucellose ne s’est propagée qu’à 25 autres vaches sur les 334 et à 33 buffles sur les 442. La fréquence moyenne de la maladie était de 7,5 % pour les deux élevages au cours des périodes de tests. L’analyse de tendance sur les proportions d’animaux positifs à chaque contrôle a révélé une réduction significative par rapport aux pourcentages initiaux. L’isolement des animaux positifs a permis de diminuer la propagation de la brucellose. Cependant, il serait nécessaire d’effectuer une étude épidémiologique sur un grand nombre d’élevages pour identifier les facteurs de risque responsables de la propagation de la maladie.

MOTS-CLÉS : Bovins - Brucella abortus - Brucellose - Buffles - Epidémiologie.

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Resumen: Los autores estudiaron la tasa de propagación de la brucelosis bovina en rebaños de búfalos y de bovinos Jersey en un centro de investigaciones sobre el ganado de Pakistán. Fueron aislados los animales seropositivos una vez identificados a partir de las pruebas serológicas clásicas, se secuestraron; aquellos demasiado viejos o poco productivos se eliminaron. Los animales seropositivos fueron así estabulados, tratados y alimentados fuera del contacto con los demás.

La prevalencia de los casos seropositivos respecto de la brucelosis en los bovinos Jersey y búfalos que se sometieron a las pruebas era inicialmente de 21,4%, con una diferencia estadísticamente no significativa (p = 0,218). En 34 meses, sólo hubo propagación de brucelosis a 25 de los 334 bovinos Jersey y a 33 búfalos de los 442. La frecuencia media de la enfermedad era de 7,5% durante los períodos de pruebas en las dos razas. El análisis de tendencia de las proporciones de animales positivos en cada control mostró una reducción significativa en relación con los porcentajes iniciales. El aislamiento de los animales positivos permitió disminuir la propagación de brucelosis. No obstante,
para identificar los factores de riesgo responsables de la enfermedad habría que realizar un estudio epidemiológico en mucho mayor cantidad de ganado.

PALABRAS CLAVE: Bovinos - Brucella abortus - Brucelosis - Búfalos - Epidemiología.

REFERENCES