Immune response of buffaloes to vaccination with *Brucella abortus* strain 19

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Summary

The immune response of buffalo calves and heifers to a full or half dose of *Brucella abortus* strain 19 vaccine was studied. Buffalo calves developed high serum agglutination test (SAT) titres following full dose vaccination. These titres declined more rapidly in calves of six months of age than in calves of eleven to twelve months of age. Specific immunoglobulin G titres, as measured by 2-mercaptoethanol-treated serum agglutination, declined much earlier than SAT titres. Buffalo heifers vaccinated with a full or half dose developed high SAT titres. The rate of decline of SAT titres in heifers was much slower than in calves. Vaccination with a half dose did not appear to offer any advantage in terms of disappearance of SAT titres.

Keywords

*Brucella abortus* – Buffaloes – Immunoglobulin G – Pakistan – Serum agglutination – Vaccination.

Introduction

Bovine brucellosis is endemic in Pakistan. In buffaloes, studies have revealed that the serological prevalence of brucellosis is 3.3% to 26.1% (2, 3, 4, 8). Incidence is higher in buffaloes maintained on organised farms, as compared to smallholdings (1), and higher prevalence rates have been observed since 1987.

No official policy of brucellosis eradication exists in Pakistan. Veterinary Services, economic conditions and methods of farming in the country, suggest that the appropriate method for the control of brucellosis is immuno-prophylaxis, although vaccines against brucellosis are not manufactured in the country. The most popular vaccine for brucellosis in large ruminants is *Brucella abortus* strain 19. Much information regarding various aspects of the use of *B. abortus* strain 19 vaccine in cattle is available in the literature (7, 10). However, similar studies, particularly on the immune response of buffaloes to strain 19 vaccine, are limited. This study was designed to determine the immune response of buffalo calves and heifers to *B. abortus* strain 19 vaccine at a full and half dose.

Materials and methods

Nili-Ravi buffaloes maintained at the Livestock Research Station of the Animal Sciences Institute, National Agricultural Research Centre, Islamabad, were screened for brucellosis using the rose bengal plate test (RBPT) and the serum agglutination test (SAT). Twenty seronegative buffaloes were selected for study. These animals included ten calves aged from six to twelve months and ten heifers between eighteen and thirty-three months of age.

*Brucella abortus* strain 19 vaccine manufactured in Turkey was used in the experiment. Vaccination was performed according to the schedule detailed below.

**Group A**

Group A consisted of ten animals aged from six to twelve months, which were given a full dose of vaccine, as recommended by the manufacturer.

**Group B**

Group B consisted of six animals (aged from eighteen to thirty-three months) which were given a half dose of vaccine.
Group C
Group C consisted of four animals (aged from nineteen to thirty-three months) which were given a full dose of vaccine.

Procedures
All animals were bled fifteen days before vaccination, on the day of vaccination and fortnightly thereafter. The serum was separated and stored at -20°C until required for analysis. The RBPT and SAT were performed as described previously (9). A mercaptoethanol (ME) agglutination test (5) was undertaken to assess the time taken for immunoglobulin G (IgG) levels to decline after vaccination. Test antigens were purchased from the Central Veterinary Laboratory, Weybridge, United Kingdom, and the Veterinary Research Institute, Lahore, Pakistan. Positive and negative control sera were obtained from the National Veterinary Research and Services Laboratory, Ames, Iowa, United States of America. Serum titres were expressed as international units (IU) per ml.

Results
All animals, except one, gave a positive result to the RBPT on day fifteen post vaccination. However, in sixteen animals, the RBPT was negative at 84 days post vaccination. Three animals continued to give positive RBPT results up to 98, 129 and 200 days post vaccination.

Based upon antibody titres, six- to twelve-month-old buffalo calves could be further divided into three subgroups. Calves of six months of age (two calves) developed SAT titres after vaccination with \( B. \ abortus \) strain 19. However, these titres declined quickly, were lower than 15 IU by forty-one days and became negligible at sixty-nine days post vaccination (Fig. 1). The ME agglutination titres (indicative of IgG) also declined sharply, and by forty-one days post vaccination, no titre was observed. However, decline of SAT titres following vaccination was less rapid in buffalo calves of eight to nine months and eleven to twelve months of age (Figs 2 and 3).

Buffalo heifers (from nineteen to thirty-three months of age) developed high SAT titres against \( B. \ abortus \) when administered the full dose of vaccine. The decline of titres thereafter was much slower and significant SAT titres were present on day 200 post vaccination, when the study was concluded (Fig. 4). Even ME agglutination titres remained high and only returned to a negligible range 176 days post vaccination. Buffalo heifers (from eighteen to thirty-three months of age) vaccinated with a half dose of \( B. \ abortus \) strain 19 vaccine also showed high titres (Fig. 5) and significant titres were present throughout the experiment. Two animals in this group exhibited high ME agglutination titres throughout the study period. Statistically non-significant differences were observed in titres of buffalo heifers vaccinated with full and half doses of the vaccine. All heifers except one were bred using artificial insemination and calved normally. One heifer vaccinated with a half dose of vaccine aborted six months and thirteen days into pregnancy.
Discussion

Use of *B. abortus* strain 19 vaccine in cattle is well established. Although primarily administered to calves, the vaccine has also been used in heifers and adult cattle. The principal problem in heifers and adult cattle has been the persistence of vaccinal titres. To overcome this problem, a reduced dose of vaccine has been advocated (6). The present study demonstrates that *B. abortus* strain 19 can also be successfully used in buffalo calves and heifers. In younger buffalo calves, the vaccinal titres disappeared sooner than in older calves and heifers. This finding is similar to that observed in cattle (7). In buffalo heifers, the vaccinal titres persisted beyond six months, but these titres could be differentiated from infected animal titres by treating sera with 2-mercaptoethanol. Vaccination with a half dose did not appear to have any advantage over the full dose. The vaccination proved useful in preventing abortion, and all vaccinated heifers except one calved normally following vaccination. Over the previous three years, the annual abortion rate at this farm ranged from 15% to 20%.

**Résumé**

Les auteurs présentent les résultats d’une étude de la réponse immunitaire de bufflons, mâles et femelles, à une dose complète ou à une demi-dose de vaccin préparé avec la souche 19 de *Brucella abortus*. Les sérums de bufflons ayant reçu une dose complète de vaccin possédaient des titres élevés d’anticorps agglutinants. Ces anticorps ont disparu plus rapidement chez les bufflons de six mois que chez ceux de onze à douze mois. Les titres spécifiques de l’immunoglobuline G agglutinée dans le sérum traité au mercaptoéthanol-2 ont diminué plus rapidement que ceux des anticorps agglutinants. Les sérums de jeunes bufflons vaccinées avec une dose complète ou une demi-dose de vaccin ont présenté des titres élevés d’anticorps agglutinants. Le délai de disparition de ces anticorps a été beaucoup plus lent chez les bufflons que chez les mâles. La vaccination avec une demi-dose ne semblait pas entraîner une disparition plus rapide des anticorps agglutinants.

**Mots-clés**

Respuesta inmunitaria de búfalos a la vacuna cepa 19 de \textit{Brucella abortus}

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Resumen
Los autores estudiaron la respuesta inmunitaria de terneros y vaquillas de búfalo a la administración de dosis enteras o medias de la vacuna cepa 19 de \textit{Brucella abortus}. Tras la administración de una dosis entera, los terneros presentan títulos elevados de aglutinación en suero, que después disminuyen con más rapidez en animales de seis meses que en ejemplares de once a doce meses de edad. Los títulos de inmunoglobulina G específica, medidos por aglutinación en suero tratado con 2-mercaptoetanol, caen mucho más rápidamente. Las vaquillas vacunadas con dosis medias o enteras presentan niveles altos de aglutinación en suero, aunque el título de anticuerpos mengua después a un ritmo mucho más lento que en los terneros. La vacunación con media dosis en lugar de una dosis entera no parece entrañar ventaja alguna en lo referente a la desaparición de los títulos de anticuerpos.

Palabras clave

References


