COMPARATIVE STUDY ON THE EFFICACY OF DRY-COW TREATMENT
REGIMEN AGAINST BOVINE MASTITIS


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ABSTRACT

The study aims to investigate the efficacy of piroline and other antibiotics in the treatment of bovine mastitis caused by Streptococcus uberis and Escherichia coli during dry-milk period. A total of 1880 cows in dry-milk period were divided into 4 groups and treated with penicillin G, ammonia benzyl penicillin, ceftiofur and piroline, respectively. The efficac for mastitis caused by E. coli were 31.2% for penicillin G, 36.9% for ammonia benzyl penicillin, 61.3% for ceftiofur, and 64.4% for piroline. For mastitis caused by S. uberis, the efficacies are 90% for ceftiofur and 94.4% for piroline. The results indicated that piroline was more effective than the other three in treating the disease. The post-treatment analysis on milk samples demonstrated absence of piroline residue. Hence, piroline could be used as therapeutic agent in treating mastitis.

Key words: Piroline; Bovine mastitis; Efficacy.

INTRODUCTION

Bovine mastitis is a major disease affecting the dairy industry and causing huge economic losses. Although much progress has been made in control of mastitis, producers still could not prevent and cure it effectively. A total of 3650 strains of 24 species of bacteria and fungi were isolated and identified from 3006 milk samples, of which 2060 strains of 12 species were closely related to cow mastitis (Yuan et al., 1992). The isolation rate of pathogenic bacteria was 62.5%. Budde and Cooper reported that about 32% cases belonged to spontaneous cure among those untreated infections over the dry period.

Dry cow treatment (DCT) is an important step of a mastitis control program, the advantages of it includes reduced incidence of intramammary infections (IMI) at parturition and increased cure rate of IMI (Buddle and Cooper, 1980). Previously reported bacteriological cure rates for various intramammary dry cow treatments ranged from 25% to 75%. Owing to the antibacterial drug resistance, only a few of antimicrobial agents demonstrated higher cure rate over conventional intramammary DCT.

Piroline is the main active compound isolated from the Rubia cordifolia, which has been used in China to treat bovine mastitis for a long time (Liang et. al., 1993; Liang et. al., 2000). The purpose of the present study was to compare the efficacy of piroline with that of other antibiotics commonly used in the systemic DCT in order to better prevention and cure of bovine mastitis.

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MATERIALS AND METHODS

Herds

The DCT field trials were conducted in three factory-supply dairy herds under seasonal-calving conditions in the Wuzhong, Ningxia Autonomous Region of China. The three factory-supply dairy herds are divided into A, B, and C groups. The number of dairy herds are 620, 708, and 552 respectively. The test were divided into wash udders group, spray treats group, treat dry-cows group, and overall management group, respectively. The results showed that A and B group were positive or good. The C group were negative or fail in the spray treats group and overall management group.

Udder selection and milk sample collection

Udders were selected and milk samples were collected through recommended methods. Composite milk samples were collected from 1880 lactating cows in the three herds within 4 weeks prior to drying off. Duplicate quarter milk samples were collected at drying off and within 21 days, single sample was collected from all quarters of cows in treatment 1 and 3 at the prepartum period prior to infection of the lactating cow product (LCP).

Drugs

Penicillin G and ammonia benzyl penicillin were obtained from North China Pharmaceutical Group Corporation, Shijiazhuang city, China. Ceftiofur was procured from Hebei Yuan Zheng Pharmaceutical CO., Ltd. Shijiazhuang, China and piroline from Lanzhou Institute of Animal and veterinary Pharmaceutics sciences of Chinese Academy of Agricultural Sciences, Lanzhou city, China.

Assignment of cows to treatment groups

Based on cultural results of composite milk samples, cows with E. coli IMI, were assigned randomly to the four treatment groups, a minimum of 80 E.coli IMI was included in each of the four treatment groups. More than 90 SU IMI were included initially in treatments 1 and 3 in anticipation of missed infusions due to early calving or incorrect calculated calving dates. Cows missed scheduled prepartum treatment were included in treatments 2 or 4, respectively. The test were divided into drying off group and prepartum group in accordance with the time of treatment the results showed all four treatment groups were positive intramammary infections.

Treatment regimens

Each group of treatments was listed in Table 2. Group 1 received an infusion at drying off with penicillin G 2000000IU/50ml, group 2 with ammonia benzyl penicillin 0.5g/50ml, group 3 with ceftiofur 0.5g/50ml, and treatments 4 with piroline 0.4g/50ml (Brander, 1969). The vehicle for infusion was water.

Microbiological procedures

Method recommended by the National Mastitis Council, U.S.A., was followed. Presumptive identification of Escherichia coli, Staphylococcus epidermidis, Streptococcus galactiae, Streptococcus uberis, Corynebacterium bovis, and Coliforms was made (S. Woubit, et al. 2001 ).

Definition of terms

Infection: the number of somatic cells in the milk samples exceeds regular range, determination of pathogenic bacteria in the milk shows positive.

Cure: clinical symptoms eases off or disappears, the number of somatic cells in the milk returns regular range, determination of pathogenic bacteria in the milk shows negative.

Fail: clinical symptoms don’t ease off, the number of somatic cells in the milk doesn’t return regular range, determination of pathogenic bacteria in the milk shows positive.

Statistical analysis

An analysis of variance was conducted only on the E.coli and S. uberis data. The number of IMI with other pathogens was insufficient to conduct valid analysis. Developed % = (developed quarters / treated quarters) × 100%, and Cured % = (cured quarters / treated quarters) × 100%.
RESULTS AND DISCUSSION

The efficacy was 61.3% against *S. uberis* IMI in treatment 3 and 64.4% in treatment 4 (Table 1). The efficacy of treatment 4 was significantly greater (P < 0.01) than the 36.9% in treatment 2, and the treatment 4 was also significantly different from the treatment 1 (31.2%).

Approximately 10.5% of quarters developed from new IMI with *E. coli* or *S. uberis* during the dry period (Table 2). These resulting pathogens were accounted for 93% of new IMI. Other new IMI were caused by *S. galactiae* and other streptococci, about 3% for each. Though differences were observed between treatment groups, the incidence of the new IMI was similar to *E. coli* and *S. uberis*. In the treatments 1 and 2, the incidence of IMI with *S. uberis* almost doubled than that in the treatments 3 and 4. Efficacy of prepartum treatment with the ceftriaxone and piroline against new *S. galactiae* IMI was low, but it was 61.3% and 64.4% for the new IMI with *S. uberis* respectively (Table 1).

Rate of new dry period IMI with *S. uberis* ranged from 3.6 to 4.9% of quarters for Treatment 1, 2 and 3. A total of 10.5% of quarters become infected with *S. uberis* in Treatment 4 (Table 2).

The treatment 4, treated with piroline, did not significantly reduce the number of *E. coli* infections postpartum when compared with the treatment 3. On the contrary, ceftriaxone showed good effect in reducing the number of *E. coli* IMI significantly when compared with treatment 1 and 2. It did not significantly reduce level of *E. coli* IMI only with ammonia benzyl penicillin for prepartum treatment as compared with penicillin. The rate of spontaneous recovery for *E. coli* during dry period was consistent with the figures previously reported. Efficacy of the piroline was 91.3% when compared with other reports on piroline against *E. coli*. Range in efficacy among herds was from 83% to 95%, which was concordant with earlier studies (Liang JP, et al., 1993).

Rate of new *E. coli* dry period IMI could be reduced 50% by DCT and supported earlier work (S. Godden, et al., 2003). The incidence of new IMI with *S. uberis* was similar to that observed with *E. coli* and was reduced about 50% by DCT (Buddle and Cooper, 1980; Brander, 1969; Brown et al., 1969; Budddie and Cooper, 1980; Christie et al., 1974). However, the incidence of new *S. uberis* IMI was similar to that in the treatments 3, and 4. The further studies are required to explain these results since no prepartum samples were collected and detected from cows in the treatments 1 and 2. Additionally, the rate of spontaneous recovery was high for new *S. uberis* IMI during the late dry or early postpartum period. Philpot (1969, 1979) reported that spontaneous recovery over the dry period was 70% for streptococci, compared with 27% for *E. coli*.

Prepartum therapy with piroline was effective in eliminating over 90% of new *S. uberis* IMI. Average efficacy against new *E. coli* IMI was less than 60%, but the number of new *E. coli* was largely reduced. A wide variation in efficacy was observed when compared with the earlier reports, but these data may not be conclusive.

**Table 1:** Efficacy of dry-cow therapy against *S. uberis.*

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Cows</th>
<th>Quarters</th>
<th>Intramammary infections</th>
<th>Efficacy (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Drying off</td>
<td>Postpartum</td>
</tr>
<tr>
<td>1</td>
<td>91</td>
<td>243</td>
<td>99</td>
<td>61</td>
</tr>
<tr>
<td>2</td>
<td>102</td>
<td>288</td>
<td>102</td>
<td>64</td>
</tr>
<tr>
<td>3</td>
<td>83</td>
<td>211</td>
<td>89</td>
<td>66</td>
</tr>
<tr>
<td>4</td>
<td>98</td>
<td>270</td>
<td>91</td>
<td>70</td>
</tr>
<tr>
<td>Totals</td>
<td>374</td>
<td>1012</td>
<td>381</td>
<td>261</td>
</tr>
</tbody>
</table>
The results validated many earlier reports on piroline in reducing the incidence of new dry period IMI with \textit{E. coli} and \textit{S. uberis}. Prepartum therapy with piroline appeared to be of marginal benefit and probably would be of practical value in dairy herds experiencing significant clinical mastitis cows. Philpot (year ) reported a 68\% reduction of clinical cases during the first week of lactation when cows received penicillin G at parturition and the end of lactation. Results from this field trial provided supportive evidence to effectiveness of piroline, eliminating many new IMI by educing levels of infected quarters before and after parturition, especially for the IMI infected with \textit{S. uberis}. 

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**Table 2**: New dry-period intramammary infections.

<table>
<thead>
<tr>
<th>Group</th>
<th>Number.</th>
<th>Intramammary infections</th>
<th>( E.) coli</th>
<th>S. uberis</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Cows</td>
<td>Quarters</td>
<td>Quarter Number</td>
<td>Developed(^a)</td>
</tr>
<tr>
<td>1</td>
<td>98</td>
<td>270</td>
<td>21</td>
<td>7.8</td>
</tr>
<tr>
<td>2</td>
<td>102</td>
<td>288</td>
<td>10</td>
<td>3.6</td>
</tr>
<tr>
<td>3</td>
<td>91</td>
<td>243</td>
<td>8</td>
<td>3.4</td>
</tr>
<tr>
<td>4</td>
<td>83</td>
<td>211</td>
<td>15</td>
<td>7</td>
</tr>
<tr>
<td>Totals</td>
<td>374</td>
<td>1012</td>
<td>54</td>
<td>5.3</td>
</tr>
</tbody>
</table>

\(^a\) Developed after prepartum treatment.

\(^b\) Expressed as percentage cure of IMI that developed prepartum sampling.

No animals were abused during the experiment. The experiment has been authorized by Lanzhou Institute of Animal Husbandry & Veterinary Pharmaceutics Sciences, Chinese Academy of Agricultural Sciences Animal ethics committee, the number is 730030530020607515.

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**REFERENCES**


