TO DRY COW TREAT OR NOT?

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SUMMARY
Total dry cow therapy is the current recommendation for non organic dairy herds in the United Kingdom but is not allowed on organically managed cows. The consequences of ceasing to use dry cow therapy on conversion need to be demonstrated to advise on likely problems and alternative management. Results from a selective dry cow trial, comparing total dry cow treatment with no treatment, on four herds in England are presented. These confirm that dry cow treatment for cows remains highly effective in preventing new infections. It reduces the rate of new infection by approximately 80% and prevents clinical mastitis in the dry period, especially when these are likely to be caused by *Streptococcus uberis*.

INTRODUCTION
The use of intramammary antibiotic to prevent intra mammary infections in the dry period was originally developed as a control measure for summer mastitis (1). Its use, applied immediately after the last milking, was later found to result in an enhanced cure rate for existing infections and to reduce the chance of new infections in the dry period (2) when these were most likely to be caused by *Staphylococcus aureus* or *Streptococcus agalactiae*. It was then combined with several other recommendations to give what is known as the “Five Point Mastitis Control Plan.”

Organic production is an increasing niche market that specifies no prophylactic antibiotic use. With current milk prices this form of milk production presents an attractive proposition. The present economic climate has also necessitated a review of current practices including total dry cow therapy.

Currently in the UK, dry cow therapy for all cows all year round is the recommended practice in conventional dairying. Increasing concerns over the widespread use of antibiotics along with the observation that now many cows at drying off are uninfected has resulted in the re-evaluation of the use of total dry cow therapy. Alternatives include selective dry cow therapy, selective quarter therapy, administration of lactation intra mammary antibiotic often for several days prior to drying off, systemic therapy, no therapy and the use of teat sealants (3-6).

Selective quarter or cow treatment requires initial screening to identify an infection and general preventive benefits of total dry cow therapy are lost. Identification of infected quarters or cows can be carried out using cell counts and or the California Mastitis Test as an initial screening method, with bacteriology for further confirmation. These are not always accurate and can add expense. Success rates for systemic treatments either alone or in combination with intra-mammary treatment have been no better than intra-mammary treatment alone. The use of systemic antibiotics at drying off may pose an extra antibiotic residue risk, with antibiotics excreted in the urine and faeces in possibly sub therapeutic concentrations.
In Norway dry cow intra-mammary formulations are not available and lactation treatments are used for infected cows (4). This generally means that more antibiotic is used and there is increased handling stress. Some organic farms are using this as an alternative to dry cow therapy.

External teat sealants have been used to try and prevent new infections during the dry period with limited success (7). Inert bismuth subnitrate as an intra-mammary sealant is available in Ireland and New Zealand, with a reported 90% reduction in new infections (6, 8). This has been used with an antibiotic or the bacteriocin lactocin or alone. This product looks very promising as an alternative to total dry cow therapy.

To assess the benefits and problems of the different strategies several factors need to be taken into account. These include –

- the current infection status of the cow and herd,
- parity
- environmental factors
- season
- potential market to be supplied
- economic circumstances.

Only the first is relevant in the initial study reported here.

**MATERIALS AND METHODS**

**Experimental design**

Initially four herds were recruited for a selective dry cow trial, two herds at the Institute for Animal Health and two herds undergoing conversion to organic status. Cows were assigned randomly within each herd to two groups: treatment and non treated. Treatment was use of Cepravin DC (Schering Plough plc) for three herds and Orbenin Extra DC (Pfizer plc) for one herd. All cows were dried off abruptly at the end of the designated milking.

**Sampling procedure**

Cows were sampled aseptically using 70% ethanol solution to clean the teats. A single 10 ml foremilk sample from each teat was collected. Samples were taken one week prior to drying off, at drying off, within 24 hours of calving where possible and 7 to 14 days after calving. Extra samples were taken if any of the previous samples were not suitable or for confirmation of infection. Sampling at pre drying off, drying off and post calving was normally on a fixed day each week and samples were examined within 24 hours of sampling. Samples at calving were stored at 3-8 °C for no more than 3 days until assay. Those from external farms were frozen if there was going to be a delay of more than 3 days between sampling and assaying.

**Laboratory methods**

Cell counting was carried out on all suitable samples using a Fossomatic machine. Microbiological examination was carried out according to IDF recommendations (9) For routine samples 0.05 ml of milk was inoculated onto aesculin blood agar. Plates were incubated for 48 hours at 35-37 °C and examined after 24 and 48 hours incubation. Colonies were provisionally identified on gross morphology and number and type of colonies were recorded. Appropriate tests were carried out on colonies
isolated, where necessary to identify the pathogens. Samples from cows with infections identified as clinical mastitis were assayed as above, in addition 0.05ml from the suspected clinically infected quarter was inoculated onto sheep blood agar, an additional aesculin blood agar and MacConkey agar.

All strains isolated from bacteriologically positive samples were frozen in 50% v/v glycerol/water solution at –20°C.

Definitions
Where the same pathogen was isolated in two consecutive samples or two out of three samples or a pathogen in one sample with a cell count elevated in comparison to the other quarter cell counts this was defined as an infection. An elevated cell count was defined as two times greater than those of the other quarters and greater than 200,000 cells per millilitre.

Clinical mastitis was defined as occurring when visible changes in the milk were seen such as watery milk, clots or flakes and changes in the udder such as swelling or heat. These were either detected by the herdsman or at one of the routine sampling points.

Analysis
Data were analysed using Minitab version 7.

RESULTS
The results for infection status are limited to streptococci, coliforms, Staphylococcus aureus, Arcanobacterium pyogenes and Proteus spp. Infections likely to be caused by coagulase negative staphylococci or Corynebacterium bovis are not included.

Logistical regression analysis was carried out on herd and dry period length. The only significant factor was a dry period length of more than 16 weeks and these cows were excluded from the analyses of results.

<table>
<thead>
<tr>
<th>Table 1 Rate of clinical mastitis occurring during the dry period for untreated and dry cow treatment animals in IAH herds.</th>
</tr>
</thead>
<tbody>
<tr>
<td>No infection</td>
</tr>
<tr>
<td>Treated at drying off</td>
</tr>
<tr>
<td>Not treated</td>
</tr>
<tr>
<td>Total no. cows</td>
</tr>
</tbody>
</table>

χ² = 7.383  p<0.01

The incidence of clinical mastitis in the dry period at IAH was 0% in dry cow treated animals and 6.5% in untreated animals, a statistically significant difference (Table 1). There was also a 100% reduction in clinical incidence in the two organic herds although this was barely statistically significant due to the small group size (Table 2).
Table 2. Rate of clinical mastitis occurring during the dry period for untreated and dry cow treatment animals in the two organic herds.

<table>
<thead>
<tr>
<th></th>
<th>No infection</th>
<th>Clinical mastitis</th>
<th>Total no. cows</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treated at drying off</td>
<td>24</td>
<td>0</td>
<td>24</td>
</tr>
<tr>
<td>Not treated</td>
<td>26</td>
<td>4</td>
<td>30</td>
</tr>
<tr>
<td>Total no. cows</td>
<td>50</td>
<td>4</td>
<td>54</td>
</tr>
</tbody>
</table>

$\chi^2 = 3.173 \  p=0.075$

During the dry period all four herds had cows that suffered dry period clinical mastitis; for 10 of 12 cows this was caused by *S. uberis*. Two cows also acquired an intra mammary infection caused by *A. pyogenes* in one quarter in addition to *S. uberis* in one or more other quarters. Two cows from IAH that had clinical mastitis in the dry period were culled before calving.

At calving all herds had a significantly greater number of new infections in the untreated cows compared to the treated cows. The percentage of cows infected at calving varied between herds and ranged from 30% to 50% at calving for untreated cows and 0% to 15% for treated cows. The difference was statistically significant at both IAH (Table 3) and on the organic herds (Table 4).

Table 3. Rate of new intra mammary infections detected at calving for IAH cows.

<table>
<thead>
<tr>
<th></th>
<th>Not infected</th>
<th>Infected</th>
<th>Total no. cows</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treated at drying off</td>
<td>98</td>
<td>13</td>
<td>111</td>
</tr>
<tr>
<td>Not treated</td>
<td>89</td>
<td>34</td>
<td>123</td>
</tr>
<tr>
<td>Total no. cows</td>
<td>187</td>
<td>47</td>
<td>234</td>
</tr>
</tbody>
</table>

$\chi^2 = 12.547 \  p<0.001$

Table 4. Rate of new intra mammary infections detected at calving in the two organic herds.

<table>
<thead>
<tr>
<th></th>
<th>Not infected</th>
<th>Infected</th>
<th>Total no. cows</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treated at drying off</td>
<td>24</td>
<td>0</td>
<td>24</td>
</tr>
<tr>
<td>Not treated</td>
<td>15</td>
<td>15</td>
<td>30</td>
</tr>
<tr>
<td>Total no. cows</td>
<td>39</td>
<td>15</td>
<td>54</td>
</tr>
</tbody>
</table>

$\chi^2 = 16.615 \  p=0.000$

Some 15 cows (15%) at IAH that had received dry cow treatment developed an infection in the dry period whilst no new intra mammary infections occurred in the two organic herds. However, all IAH cows were uninfected at drying off whilst of the 24 cows in the treated group on the organic farms 6 were already infected in one or more quarters at drying off. There was a different risk attached to the two groups.

The two organic herds both untreated groups had a higher percentage of cows (50%) infected at calving than the IAH herds (28%). In the untreated group 60% of new infections were caused by *S. uberis* compared with 50% in the untreated group. In those cows infected at calving that subsequently showed clinical signs in the same quarter with the same pathogen, 50% were caused by *S. uberis*. 


At drying off no cows enrolled at the Institute for Animal Health (IAH) were infected with *S. uberis, S. aureus, S. agalactiae, Streptococcus dysgalactiae* or coliforms. On the two organic herds the cows were allocated to treatment or non-treatment groups irrespective of their infection status at drying off. In these herds 14 cows were infected with *S. aureus* at drying off and only one cow of these cows, in the treated group, appeared uninfected at calving indicating a very low cure rate. The spontaneous cure rate for infections from the untreated group was zero (Table 5).

**Table 5. Number of infections persisting through the dry period in cows from the two organic herds.**

<table>
<thead>
<tr>
<th></th>
<th>Infected at drying off</th>
<th>Infections persisting at calving</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treated</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>Not treated</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>Total</td>
<td>14</td>
<td>13</td>
</tr>
</tbody>
</table>

**DISCUSSION**

There were significant differences in the new infection rates and the incidence of clinical mastitis during the dry period, at calving and in the subsequent lactation between the untreated and treated cows from all herds. There were many more cases of sub clinical and clinical mastitis in the untreated cows. More than 50% of the infections were caused by *S. uberis*. This indicates the importance of dry cow therapy in both low cell count, uninfected cows and infected cows under current management situations. In this trial provisional analysis has indicated that there is no reduced risk of infection when cows are outdoors during the summer months.

The non lactating udder is highly susceptible to certain infections and 50% of intramammary infections acquired during the dry period will persist into the next lactation if not eradicated by appropriate treatment (10). During the dry period new infection rates are highest in the early dry period, lowest when involution is complete and increase as parturition approaches. New infection rates at calving in this trial varied between herds and ranged from 30% to 50% of cows at calving in untreated groups and 0% to 15% in treated groups. Over 50% of these infections at calving were due to *S. uberis*. The significantly lower rate of infection caused by *S. uberis* in dry cow treated cows shown in this study highlights the importance of dry cow therapy for preventing infections during the early dry period.

All the cows that showed clinical signs during the dry period had at least one quarter infected with *S. uberis*. The clinical infection rate during the dry period was not as high as that reported from Australia workers where cows were sampled periodically during the dry period (11). This may be due to the fact that their cows were more closely observed during the dry period. The dry period clinical mastitis incidence in the two IAH herds declined over the trial period. One possible reason for this may be an improvement in dry cow management. Alternatively, if dry cow management had not changed, more attention may have been paid to the cows in the initial stages of the trial due to reservations by the farm staff on the impact of not treating cows. This change in incidence was also noted in one of the organic herds.
There was a low cure rate in both treated and non-treated groups of infections present at drying off. As all these infections were caused by *S. aureus* this probably influenced the low rates obtained.

**CONCLUSIONS**

Dry cow therapy is still an essential part of controlling intra mammary infections during the dry period and the subsequent lactation, even in low cell count herds, in England throughout the year. The consequences of failing to use dry cow treatment are likely to include an increased prevalence of intra mammary infection, more dry period clinical mastitis and poorer milk quality. The later is shown by an increase in the bulk milk tank cell count for all herds. This might be assumed to increase faster if no cows received dry cow treatment. These factors will contribute to a decline in cow well-being.

**ACKNOWLEDGEMENT**

To everyone who has helped.

**REFERENCES**


