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Effect of dry cow therapy on incidence of clinical mastitis, milk yield and composition in crossbred cows

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ABSTRACT

Mastitis is considered as one of the important production disease in dairy cows which incurs huge economic losses to dairy industry, despite considerable efforts has been dedicated to solve it for the last two decades. In the present study, the impact of dry cow therapy (DCT) on incidence of clinical mastitis, milk yield and composition in crossbred cows was studied. About 20 healthy crossbred cows were selected at dry-off and randomly allotted either to control or treatment group. Daily milk yield of cows was recorded up to 45 days post-partum and fortnightly separate quarter wise milk samples were collected for estimation of milk composition. While no quarter in the treatment group showed clinical mastitis, 33.33% of quarters in control group showed clinical mastitis within 45 days post-partum. Milk production increased by 9.71, 8.40 and 18.18% during first, second and third fortnight with overall value 11.84% during the entire 45 days post-calving period in DCT treated cows compared to control group. Also, the overall fat-corrected milk, solid-corrected milk and energy-corrected milk production following 45 days post-partum increased significantly ($P<0.05$) by 22.71, 23.70 and 22.80%, respectively in treated group than control group. However, overall mean milk components such as fat, protein, lactose, SNF and TS remained similar between treatment and control groups. Taken together, the above results indicated that DCT increased milk yield by reducing incidence of clinical mastitis during early lactation.

Key words: Clinical mastitis, Crossbred cows, Dry cow therapy, Milk composition, Milk yield.

INTRODUCTION

In dairy animals, mastitis is considered as an important production disease which causes huge economic losses and accounts about INR 7165.51 crores loss per annum (NAAS, 2013). Incidence of clinical mastitis in crossbred cows varied from 14.0 to 38.46% (Pal, 2003; Sharma, 2010; Jingar *et al*., 2014). The milk loss of about 29 kg per case and 552 kg per lactation, and treatment cost of about INR 275 per case with total economic losses of INR 4360 per cow per lactation has been reported (Pal, 2003; Sharam, 2010). Therefore, proper control and preventive measures of mastitis could improve udder health and subsequent milk production.

Dry Cow Therapy (DCT) is generally recommended as a mastitis control measure to cure the existing sub-clinical infection as well as to prevent the new infection. Dry period is considered as a very important stage of lactation and during this period mammary gland regenerates alveolar secretary tissues in preparation for the next lactation and provides an ideal opportunity to treat existing intramammary infection (IMI). Though IMI during dry period may not appears as clinical, there is a higher chance that if sub-clinical condition exists during dry period it may develop into clinical condition soon after calving (Green *et al*., 2002). It has been reported that if infected cows are not treated properly during dry period then it would have accounted for more than 76% infections at calving and about 70% at mid-lactation (Browning *et al*., 1994). In the absence of effective mastitis prevention and control measures during the dry period, more quarters of the udder will be infected at calving in comparison with the number infected at drying off (Sanford *et al*., 2006; Newton *et al*., 2008; Bradley *et al*., 2010). Although information on DCT and its effectiveness in reducing mastitis is available in high yielding purebred cows, its efficiency in crossbred cows has not been studied in details. Hence, the present investigation was undertaken to study the effect of DCT on incidence of clinical mastitis, milk yield and composition in crossbred cows.

MATERIALS AND METHODS

Animal selection and general management: The present study was conducted at Livestock Research Centre, ICAR-National Dairy Research Institute, Karnal, Haryana, India on twenty advance pregnant, healthy crossbred (Holstein Frisian × Tharparkar) cows (2^{nd}-5^{th} parity and peak yield >15

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kg) approaching towards drying off. Following criteria was considered for selection of experimental cows i.e. a) cows in good general health, b) had at least three functioning quarters, c) not received parenteral or intramammary treatment with an antibacterial or anti-inflammatory medication during a 30day period immediately prior to dry off and d) with no clinical signs of mastitis on the day of dry off. The experimental procedures were approved by the Institutional Animal Ethics Committee.

Administration of dry cow therapy (DCT): On the day of dry off, cows were randomly allocated to 2 groups (each 10 cows) based on expected producing ability. In the treatment group, cows were administered with broad-spectrum third-generation cephalosporin i.e., Ceftiofur antibiotic (500 mg of Ceftiofur as the hydrochloride salt). DCT was administered through intra-mammary route aseptically and after administration the quarters were dipped with a post-milking disinfectant (0.5% iodine) on the day of drying.

Mastitis monitoring and recording of milk yield and composition: Experimental cows were regularly checked for udder swelling, any change in milk colour or consistency up to 45 days after calving. The cows were considered as affected with clinical mastitis when there was visible change in milk with or without udder swelling.

Daily milk yield of cows was recorded up to 45 days post-partum and fortnightly separate quarter wise milk samples were collected for estimation of milk composition. Milk yield was recorded by digital display of automated milking machine (DeLaval). Milk fat, protein, lactose, Solid not fat (SNF) were estimated by automatic milk analyzer Lactostar. The 4% fat-corrected milk (FCM), solid-corrected milk (SCM) and energy-corrected milk (ECM) yield were calculated by standard formulas (Nawaz *et al*., 2007; Ardalan *et al*., 2010).

FCM yield (kg) =

$$([0.4 \times \text{kg milk}] + [15 \times \text{kg milk}])$$

SCM yield (kg) =

$$([12.3 \times \text{kg fat}] + [6.56 \times \text{kg SNF}] - [0.0752 \times \text{kg milk}])$$

ECM yield (kg) =

$$([0.327 \times \text{kg milk}] + [12.95 \times \text{kg fat}] + [7.2 \times \text{kg protein}])$$

Statistical analysis: Incidence of clinical mastitis between DCT treated and control groups were compared by chi-square test. The variation of milk production and milk composition between treated and control groups were compared by t-test. Statistical analysis was carried out using SPSS software package (Version 16.0, USA) and difference was considered as statistically significant if $P \leq 0.05$.

RESULTS AND DISCUSSION

Incidence of clinical mastitis: In the present study, dry cow therapy (DCT) significantly reduced the occurrence of clinical mastitis within 45 days post-calving in crossbred cows. In DCT treated group, out of 33 quarters, no quarter was observed to be affected with clinical mastitis but in control group, 12 out of 36 quarters (33.33%) were observed to be affected with clinical mastitis. While considering clinical mastitis at animal level; 4 animals (40%) out of 10 had clinical mastitis. Our observations are in consonanace with those reported by Woolford *et al*. (1998), who observed 2.3 and 13% infection at calving (at quarter level), respectively in cows with and without DCT. McDougall (2010) observed that 9% of uninfected and untreated glands developed new intra-mammary infections over the dry period in pasture-grazed cows, compared to 2-2.5% protected by antibiotic DCT. Further Scherpenzeel *et al.* (2014) reported 1.7 times higher incidence of clinical mastitis at quarter level in cows dried off without antibiotic than control. Previous studies reported lower incidence of clinical mastitis (3-6% at quarter level and 10.1-14.2% at cow level) during early lactation in dairy cows treated with DCT (Godden *et al*., 2003; Gundelach *et al*., 2011; Arruda *et al*., 2013; Johnson *et al*., 2016). Further, meta-analysis study on dry cow therapy indicated that quarters infused with DCT have higher cure risk and lower new IMI risk over the dry period than untreated quarters (Halasa *et al*., 2009). All this foregoing discussion indicates that use of DCT either as preventive or curative measure downsized the incidence of mastitis. Further the antibiotic used in the study has been reported to be comparatively more efficient (Pinedo *et al*., 2012; Arruda *et al*., 2013) for prevention and control of udder infection. The decreased incidence of clinical mastitis in DCT group might be due to elimination of infections from udder during the dry period, and higher incidence of clinical mastitis in untreated group may be due to some cows acted as a reservoir of pathogen for re-infection in subsequent lactation (Schukken *et al*., 2003).

Milk production: The average daily milk production between cows with- and without- DCT differed significantly ($P<0.01$) during 45 days post-partum (Table 1). In DCT treated cows, the milk production increased by 9.71, 8.40 and 18.18% during first, second and third fortnight with overall value 11.84% during the entire 45 days post-calving. The higher milk yield obtained in DCT treated cows is in agreement with previous reports in dairy cows (Macmillan *et al*., 1983; Berry *et al*., 1997). Macmillan *et al*. (1983) reported 64 kg more milk during early lactation in dairy cows with DCT compared to untreated cows. Berry *et al*. (1997) reported about 1.5 kg/day more milk yield during subsequent

Table 1: Effect of dry cow therapy on milk production (kg/d).

Days in milk	Treatment	Control
1-15	$15.70^{a} \pm 0.21$	$14.31^{b} \pm 0.18$
16-30	$16.90^{a} \pm 0.13$	$15.59^{b} \pm 0.085$
30-45	$16.84^{a} \pm 0.12$	$14.25^{b} \pm 0.15$
Overall	$16.44^{a} \pm 0.128$	$14.70^{b} \pm 0.127$

Means with different superscripts within a row differed significantly ($p<0.05$)

lactation up to 17 weeks in cows treated with antimicrobial agents at the end of lactation compared to control group which is supported by our results; in our study, 1.74 kg/day more milk was observed in DCT treated cows during 45 days post-calving compared to control cows. Further, FCM, SCM and ECM production were estimated and we observed that cows treated with DCT produced significantly ($P<0.05$) higher FCM, SCM and ECM during first and third fortnight compared to those without any treatment (Table 2). The overall average FCM, SCM and ECM production increased significantly ($P<0.05$) by 22.71, 23.70 and 22.80%, respectively in DCT group than control group. The increased milk production might be due to eradication of infection within the mammary gland and preventing damage to the secretary cells. Lower milk yield in control group may be due to occurrence of mastitis compared to treated group, which subsequently causes damage to secretary cells of mammary glands. Hortet and Seegers, (1998) reviewed milk losses due to clinical mastitis in dairy cows, and observed on an average 4-6% milk loss at lactation level, where higher loss was associated with occurrence of mastitis before peak yield. Previous studies also reported milk loss due to udder infection in crossbred cows – about 4.8 kg/ day and about 28.8 kg/case (Sharma, 2010) with 552 kg milk loss per lactation (Pal, 2003). Moreover previous studies revealed that Jersey heifers treated with Intramammary antibiotic pre-partum produced 531 kg more milk per lactation compared to those without treatment (Oliver *et al.*, 2003 and Owens *et al.*, 2001)

Milk composition: Effect of dry cow therapy on milk composition is presented in Table 3. There was no significant difference in milk composition (fat, protein and lactose) between treatment and control groups except that milk SNF and total solids (TS) differed significantly ($P<0.05$) between treated and control group during 3rd fortnight only. In line with our observations, Macmillan *et al.* (1983) observed non-significant effect of DCT on milk fat yield during early lactation as well as throughout the entire lactation. The variation of SNF and TS between control and treatment group might be attributed to the variation of udder infection in control and treatment groups. Previous study reported lower SNF in milk dairy animals affected with udder infection might

Table 2: Effect of dry cow therapy on fat-corrected, solid-corrected and energy-corrected milk production.

Parameters	**Days in milk**			
	d+15	**d+30**	**d+45**	**Overall**
FCM yield(kg/d)				
Control	$11.86^a±0.81$	$13.46^a±1.12$	$12.58^a±1.44$	$12.64^a±0.65$
Treatment	$14.94^b±0.87$	$15.52^a±0.92$	16.07b±1.07	15.51b±0.53
SCM yield(kg/d)				
Control	$11.6^a±0.75$	$13.33^a±1.12$	$12.55^a±1.37$	$12.49^a±0.63$
Treatment	$14.66^b±0.89$	$15.62^a±1.01$	$16.05^b±1.16$	15.45b±0.57
ECM yield(kg/d)				
Control	$13.24^a±0.82$	$14.99^a±1.22$	$14.01^a±1.54$	$14.08^a±0.69$
Treatment	$16.58^b±0.99$	$17.49^a±1.12$	$17.81^b±1.22$	$17.29^b±0.62$

Means with different superscripts within a column differed significantly ($p<0.05$)

Table 3: Effect of dry cow therapy on milk composition.

Parameters	**Days in milk**			
	d+7	**d+20**	**d+45**	**Overall**
Fat (%)				
Control	$3.26^a±0.15$	$3.35^a±0.14$	$3.20^a±0.17$	$3.27^a±0.09$
Treatment	$3.39^a±0.09$	$3.11^a±0.07$	$3.39^a±0.11$	$3.3^a±0.06$
Protein (%)				
Control	$3.56^a±0.13$	$3.53^a±0.09$	$3.49^a±0.12$	$3.53^a±0.06$
Treatment	$3.50^a±0.06$	$3.60^a±0.10$	$3.42^a±0.09$	$3.51^a±0.05$
Lactose (%)				
Control	$4.11^a±0.09$	$4.34^a±0.09$	$4.30^a±0.10$	$4.25^a±0.06$
Treatment	$4.26^a±0.06$	$4.31^a±0.05$	$4.41^a±0.09$	$4.32^a±0.04$
SNF (%)				
Control	$9.30^a±0.18$	$9.3^a±0.12$	$9.1^a±0.14$	$9.24^a±0.08$
Treatment	$9.31^a±0.11$	$9.36^a±0.08$	$9.5^b±0.07$	$9.41^a±0.05$
Total solids (%)				
Control	$12.56^a±0.30$	$12.64^a±0.25$	$12.31^a±0.21$	$12.50^a±0.14$
Treatment	$12.7^a±0.12$	$12.48^a±0.14$	$12.95^b±0.15$	$12.7^a±0.09$

Means bearing different superscripts within a column differ significantly ($p<0.05$)

be associated with alteration of synthetic activity of glandular epithelial cells or leakage of milk constituents from milk to blood (Bansal *et al*., 2007). Though, mastitis consistently alters milk lactose in buffaloes (Patbandha *et al*., 2015), in our study such variation was not observed.

The interesting part of the study lies with the finding that there were no incidences of mastitis either at quarter level or at animal level. Further the cows in control group produced comparatively higher milk during the study period. An added advantage with this therapy is that single administration is sufficient to take care of mastitis during post-partum period. All these collectively indicate that the DCT is most successful in reducing the chances of mastitis in crossbred cows. Thus, it can be suggested that the farmers maintaining high yielding elite cows could reduce the milk loss due to mastitis and improve the udder health by implementing DCT as routine management intervention.

CONCLUSION

The results of the present study indicated that DCT reduced the incidence of clinical mastitis during early lactation. Further, the milk yield was higher in DCT treated cows compared to control cows although the milk composition remained almost same between groups. Collectively, our findings indicate that DCT can be used as preventive measure for mastitis in crossbred cows.

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