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Original Research Article

Effect of α-Tocopherol Acetate and Zinc Supplementation on Milk Composition in Crossbred Cows

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Keywords

Milk composition, Somatic cell count, Transition period, α-tocopherol acetate, Zinc

A B S T R A C T

The study was conducted to investigate the effect of α-tocopherol acetate and zinc on milk composition in Karan Fries cows. Twenty pregnant Karan Fries cows were selected two months before expected date of calving. The experimental animals were randomly divided in to two groups namely control group (ten cows) and treatment group (ten cows). Treatment group cows were supplemented with α-tocopherol acetate @ 1000 IU/day/cow and zinc @ 60 ppm/day/cow. Milk fat % was lower in treatment group than control group but the overall fat in treatment group was found significantly higher than control group (4.47±0.20 vs. 3.95±0.27, P<0.01). The overall mean milk protein % was found 3.08±0.04 vs. 3.05±0.11, milk lactose % 4.47±0.08 vs. 4.48±0.10 and SNF % 8.17±0.15 vs. 8.15±0.17 in control group and treatment group, respectively which showed that there was no significant difference between the groups. The overall mean (±SEM) of somatic cell count of milk was found significantly lower (P<0.001) in treatment group than control group. The results of this study indicated that supplementations of antioxidants like α-tocopherol acetate and zinc have beneficial effects in improving quality of milk.

Introduction

For good quality dairy products there is need to know the quality aspects of milk produced. Since the diet is the fastest way to modify the milk production and quality in animals, even if the relations between the feeding and milk composition are quite complex. Trace elements, along with vitamins and minerals, are essential nutrients for cellular metabolism. They are critical components of almost every aspect of how a body grows, develops, functions and reproduces. Vitamin E is crucially involved in immune system function, such that supplementation with supranutritional levels of the vitamin E, results in improved immune responses and milk production (Chawla and Kaur, 2005; Baldi, 2005; Baldi *et al.*, 2008; Chandra and Aggarwal, 2009). There was significant decrease of somatic cell count (SCC) in milk at 15 days of lactation (0.29×10^6 vs. 0.86×10^6) in cows supplemented with 1000 IU vitamin E / day during dry period (Kaur *et al.*, 2002). The somatic cell count is internationally recognized as a parameter for assessing the milk quality and udder health. The present

study was also planned to explore the effect of tocopherol acetate and zinc supplementation on milk composition in Karan Fries cows.

Materials and Methods

The experiment was approved by the Institutional Animal Ethics Committee (IAEC) constituted as per the article number 13 of the CPCSEA-rules, laid down by Government of India.

Experimental design and treatment

For the present study 20 Karan Fries (KF) peripartum cows were selected from the herd of National Dairy Research Institute (NDRI), Karnal, 10 cows kept in Control group and other 10 cows in Treatment group. The cows in the control group were supplemented with no vitamins, while treatment group were given 1,000 IU of α-tocopherol acetate and 60 ppm zinc per cow per day from 60 days prepartum to 60 days postpartum. All the animals were fed on a ration consisting of concentrate mixture and roughages (berseem, maize or jowar fodder) as per the availability in the farm. Fresh tap water was available throughout the day to all the animals. Concentrate mixture consisted of mustard cake, maize, wheat bran, rice bran, mineral mixture and salt was given @1 Kg per cow per day, then 2 kg per cow per day 15 days before calving. After calving, the cows were given concentrate mixture @ 1 Kg per 2.5Kg of milk producing morning, noon and evening at the time of milking.

Sampling and sample analysis

Milk samples were collected weekly from all the cows for the estimation of somatic cell count, fat, protein, lactose and SNF. Somatic cell counts of milk samples were measured microscopically by the method of Singh and Ludri (2000). Statistical analysis of data was carried out to find the mean ± SE. Two way ANOVA was done to find significant difference between groups and days of experiment and their interaction by using SYSTAT 3.1 (2004) software. The correlations among the various parameters were also calculated (Snedecor and Cochran, 1994).

Results and Discussion

Milk composition

The overall mean milk fat % was found 4.47±0.20 vs. 3.95±0.23 which showed that there was a significant ($P<0.01$) difference between the groups (Table 2). Milk fat % was lower in treatment group than control group but the overall fat in treatment group was found higher than control group may be due to higher milk yield in treatment group. The overall mean milk protein % was found 3.08±0.04 in control group vs. 3.05±0.11 in treatment group which showed that there was no significant difference between the groups. The overall mean milk lactose % was found 4.47±0.08 in control group vs. 4.48±0.10 in treatment group which showed that there was no significant difference between the groups. The overall mean milk SNF % was found 8.17±0.17 in control group vs. 8.15±0.15 in treatment group which showed that there was no significant difference between the groups. Liefers *et al.*, (2003) found there was no significant difference in milk components (fat, lactose, and protein yields in Kg), probably because percentages of milk components often are lower at higher milk yields. Salama *et al.*, (2003) observed that concentration of milk fat was lower in Zn methionine supplemented goats than the control. This tendency was probably due to dilution effect because supplemented goats yielded slightly more milk than control.

Fig.1 Milk Composition (Milk Fat%, Milk Protein%, Lactose% and SNF%) in control and treatment groups

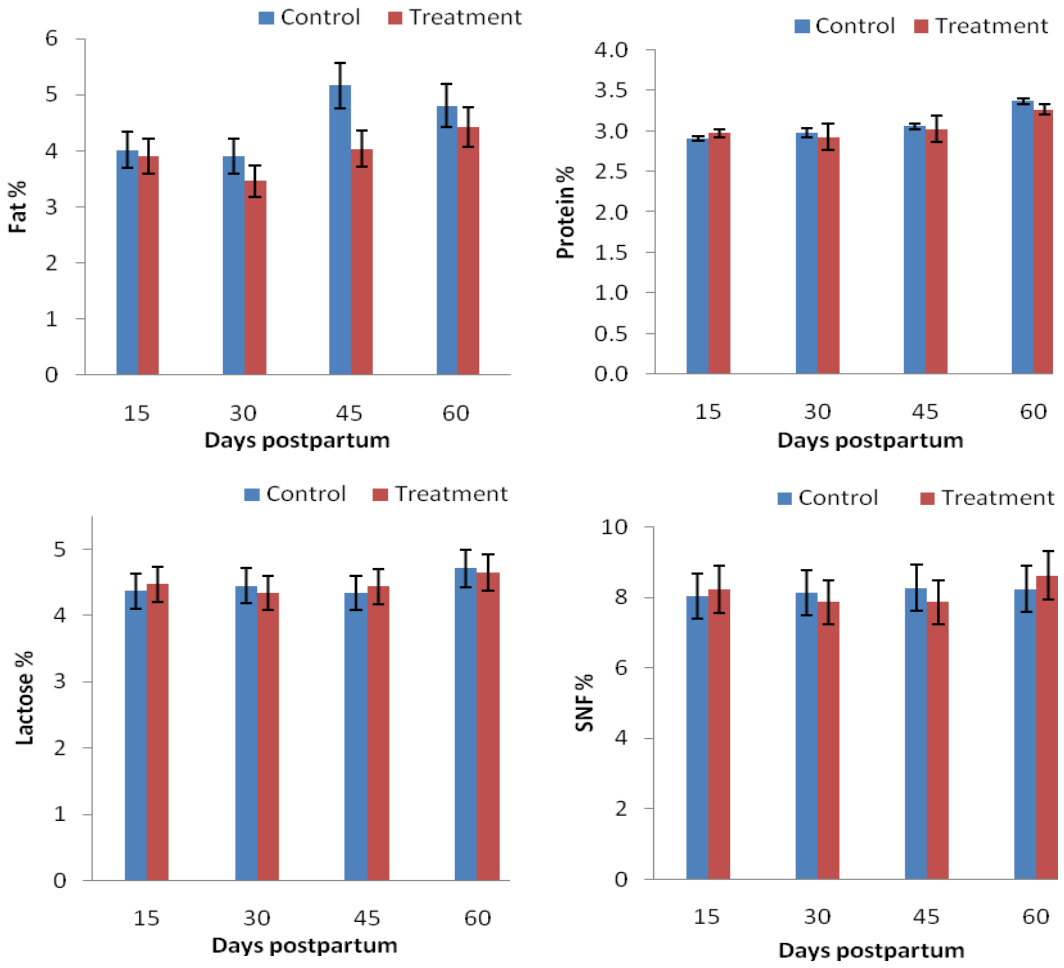

Fig.2 Somatic cell count (lakh/ml) in control and treatment groups

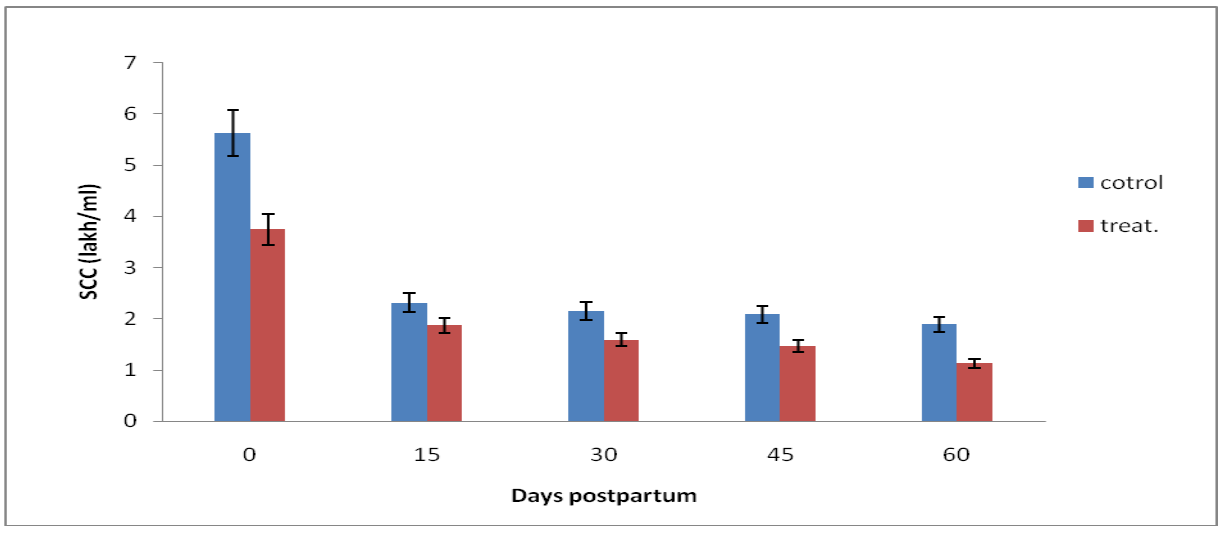

Table.1 Mean±SEM of milk fat%, protein%, lactose% and SNF% in control and treatment group with different superscript, small letters in a row and capital letters in a column differ significantly (P<0.05)

Week	Fat%		Protein%		Lactose%		SNF%	
	Control	Treatment	Control	Treatment	Control	Treatment	Control	Treatment
1st	4.04±0.14^{Aa}	3.90±0.15^{Aab}	2.91±0.03^{Aa}	2.98±0.05^{Aa}	4.37±0.04^{Aa}	4.47±0.07^{Aab}	8.02±0.07^{Aa}	8.11±0.15^{Aa}
2nd	3.91±0.36^{Aa}	3.49±0.25^{Aa}	2.98±0.06^{Aa}	2.93±0.16^{Aa}	4.45±0.09^{Aa}	4.34±0.12^{Aa}	8.08±0.15^{Aa}	8.08±0.24^{Aa}
3rd	5.16±0.19^{Ab}	4.03±0.42^{Bcd}	3.06±0.04^{Aa}	3.03±0.16^{Aa}	4.34±0.17^{Aa}	4.44±0.18^{Aab}	8.28±0.10^{Aa}	8.06±0.26^{Aa}
4th	4.80±0.12^{Ab}	4.42±0.24^{Ad}	3.39±0.04^{Ab}	3.27±0.07^{Bb}	4.71±0.03^{Ab}	4.65±0.04^{Ab}	8.10±0.31^{Aa}	8.63±0.08^{Bb}
5th	3.96±0.10^{Aa}	3.99±0.14^{Abc}	2.94±0.04^{Aa}	2.99±0.05^{Aa}	4.41±0.05^{Aa}	4.51±0.09^{Aab}	8.19±0.10^{Aa}	8.15±0.13^{Aa}
6th	3.90±0.36^{Aa}	3.53±0.24^{Aab}	2.96±0.06^{Aa}	2.91±0.16^{Aa}	4.42±0.09^{Aa}	4.31±0.09^{Aa}	8.19±0.17^{Aa}	7.87±0.20^{Ba}
7th	4.97±0.24^{Ab}	3.74±0.23^{Bab}	3.05±0.04^{Aa}	3.06±0.16^{Aab}	4.36±0.17^{Aa}	4.48±0.18^{Aab}	8.22±0.06^{Aa}	7.87±0.21^{Ba}
8th	5.00±0.11^{Ab}	4.49±0.20^{Bd}	3.37±0.03^{Ab}	3.24±0.07^{Bb}	4.67±0.06^{Ab}	4.64±0.04^{Ab}	8.31±0.22^{Aa}	8.48±0.13^{Ab}

Table.2 Overall Mean±SEM of various parameters along with P-values of α-tocopherol acetate + Zinc supplemented treatment cows and control cows

Parameter	Overall Mean±SEM		P-Values		
	Control	Treatment	Group	Day	Group × day
Fat%	4.47±0.20	3.95±0.23	0.007	0.001	0.258
Protein%	3.08±0.04	3.05±0.11	0.602	0.002	0.947
Lactose%	4.47±0.08	4.48±0.10	0.905	0.027	0.684
SNF%	8.17±0.15	8.15±0.17	0.853	0.103	0.107
Somatic cell count (lakh/ml)	2.81±0.07	1.99±0.05	<0.001	<0.001	<0.001

Somatic cell count

There was decrease in somatic cell count of milk in control and treatment cows from day of calving (colostrum) to 60 days after parturition (Table 2 and Fig 1). The overall mean (±SEM) of somatic cell count of colostrum was found significantly (P<0.001) lower in treatment group than control group (3.75±0.05 vs. 5.63±0.23 lakh/ml; Fig 2).

Heifers supplemented with 1000 mg vitamin E per day during dry period led to decrease in somatic cell counts to less than 2 lakhs in 66% cases (Smith *et al.*, 1985).

The overall mean (±SEM) of somatic cell count of milk was found 2.81±0.07 and 1.99±0.05 lakh/ml in control and treatment group, respectively which showed significantly lower somatic cell count in treatment group than control group (P<0.001; Table 2). Politis *et al.*, (1995) reported that vitamin E supplementation @ 3000 mg/cow/day from 4 week before to 8 week after calving along with an additional 5000 mg vitamin E injection 1 week before calving resulted in significant decrease in milk SCC.

There was significant decrease of SCC in milk at 15 days of lactation (0.29 x 10^6 vs. 0.86 x 10^6) in cows supplemented with 1000 IU vitamin E / day during dry period (Kaur *et al.*, 2002) and in Zn-Methionine fed group than for control goats Salama *et al.*, (2003).

The results of this study indicated that Somatic cell count (SCC) of the milk was decreased significantly in α-tocopherol acetate and zinc supplemented group as compared to control group over 60 days of lactation period. There was no significant difference in milk composition of the cows.

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