Original Research

Effect of Supplementing Selenium Yeast and Vitamin E on Performance of Lactating Buffaloes

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Abstract

To assess the effect of supplementing selenium (Se) yeast and vitamin E on milk yield, milk composition and milk somatic cell count (SCC), twenty four lactating Murrah buffaloes were selected and divided into four groups of six each viz. T_0 (control) and T_1, T_2, T_3. Buffaloes under T_1 were supplemented with Se (0.3 mg / kg DMI), while those under T_2 were supplemented with vitamin E (40 IU / kg DMI); the group T_3 were supplemented with a combination of Se (0.3 mg / kg DMI) and vitamin E (40 IU / kg DMI) during trial period of 90 days. Milk yield of the experimental animals was recorded daily; milk samples were collected weekly for milk composition (fat, protein, lactose and solid non-fat) and SCC was done fortnightly. The results indicated that the DM, TDN, DCP intake, milk yield, FCM yield and milk composition i.e. protein, fat and total solids were non-significant among experimental groups. However, milk SNF percent was significantly ($P \leq 0.05$) higher in T_3 group. Milk lactose percent was significantly higher ($P \leq 0.01$) in supplemented groups than control. SCC was significantly ($P \leq 0.01$) lowered in T_3 group. Thus, in the present study Se yeast and vitamin E supplementation to Murrah buffaloes had non-significant effect on DMI, TDN, DCP intake and milk yield, whereas milk SNF and lactose percent was significantly increased with reduction in SCC in the supplemented group.

Key words: Buffaloes, DMI, Milk Yield, Milk Composition, Somatic Cell Count, Selenium Yeast, Vit. E

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Introduction

Se and vitamin E are essential micronutrients in ruminant's nutrition. Se is a powerful catalytic element constituting the active centre of about 20 seleno-proteins (Behne and Kyriakopoulos, 2001). Also, Se and vitamin E can act on neutrophils and consequently reduces the incidence of inflammatory processes such as mastitis which is one of the challenges in dairy industry causing severe losses. The losses due to mastitis are not only economic but issues like animal health and welfare, quality of milk, antibiotic usage and the human health are also important reasons to focus on mastitis control programme. In ruminants, deficiencies of either vitamin E or Se have been associated with increased incidence and severity of intra-mammary infections and higher SCC in individual cows (Moeini *et al*., 2009). SCC is a primary indicator of mastitis and milk quality in dairy herd (Weiss, 2003).

In particular, there are a limited number of reports on the combined effect of vitamin E and Se on milk and milk composition and udder health. It was therefore proposed to study the effect of supplementation of Se yeast and vitamin E on milk yield and its composition, feed intake and efficiency of feed utilization and SCC in lactating buffaloes with its economics.

Materials and Methods

Experimental Animals and Feeding

The present research work was undertaken at Aarey dairy, Mumbai, and in the Department of Animal Nutrition, Bombay veterinary college, Parel, Mumbai. Twenty four lactating Murrah buffaloes in early stage of lactation were selected in this experiment on the basis of daily milk yield. Selected buffaloes were divided into four groups of six each. The first group of six buffaloes was kept as control; the other three groups were supplemented with Se (0.3 mg/kg DMI, as Se yeast; T_1), vitamin E (40 IU/kg DMI, as DL-alpha-tocopheryl acetate; T_2) and both Se and vitamin E at the same levels (T_3) and fed for 90 days. The supplemental level of Se and vitamin E was decided as per the recommendation of NRC, (2001). The buffaloes of all four groups had similar body weight (400±50kg) and milk yield. All buffaloes were fed as per standard feeding practices (NRC, 2001). The ingredients inclusion levels of concentrate mixture and daily feed consumption of buffaloes in four groups is given in Table 1 and 2 respectively. In control and treatment groups roughage feeding and all the management practices were the same.

Table 1: Ingredients inclusion level (%) of concentrate mixture on DM basis were as follows-

Ingredients (%)	**T_0**	**T_1**	**T_2**	**T_3**
Ground maize	39.72	39.72	39.72	39.72
Cottonseed cake	22.37	22.37	22.37	22.37
Ground nut cake	8.82	8.82	8.82	8.82
Tur chuni	10.52	10.52	10.52	10.52
Cotton seed hulls	14.15	14.15	14.15	14.15
Bread	4.42	4.42	4.42	4.42
Total	100	100	100	100
Se (mg/kg DM)	-	0.3	-	0.3
Vitamin E (IU/kg DM)	-	-	40	40

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Table 2: Daily feed intake of the experimental buffaloes

Experimental Groups	T_0	T_1	T_2	T_3
Feed Intake (kg/day/animal)				
Concentrate	7.54	7.54	7.26	7.5
Paddy straw	7.25	7.3	7.52	7.48
Para grass	9.38	9.45	9.38	9.66

Measurements

Feed intake after weighing feed refusals were recorded and DM intake were calculated daily. Milk yield of the experimental animals were recorded daily. Milk samples were collected weekly from all buffaloes for milk composition and SCC were estimated fortnightly. Representative samples of concentrate mixtures, paddy straw and para-grass used for feeding of animals were collected at fortnightly interval throughout the experimental period, oven dried and the pooled samples were analyzed. The analysis for proximate principles (Table 3) was undertaken as per A.O.A.C. (2005); calcium and phosphorus estimation were done as per Talapatra *et al.* (1940).

Table 3: Chemical composition (%) of concentrate mixture, dry and green roughage on DM basis were as follows-

Nutrient (%)	Concentrate Mixture	Paragrass	Paddy Straw
Moisture	10.38	73.63	10.67
Organic matter	94.79	90.38	88.59
Crude protein	17.86	9.83	3.28
Ether extract	3.15	3.18	1.41
Crude fiber	16.22	25.34	33.73
Nitrogen free extract	57.56	52.03	50.17
Total ash	5.21	9.62	11.41
Calcium	0.87	0.22	0.32
Phosphorus	0.42	0.18	0.14

Milk Composition

Milking of buffaloes was done manually twice daily at 5 AM and 5 PM. The individual milk yields were recorded in kg at each milking. Milk composition *i.e.* fat, protein, lactose, SNF and total solids were determined weekly by using automatic milk analyser (Milko-scan, Made in Bulgaria, Serial No. 14 - 9417). About 100 ml of milk sample from individual animal of each milking was collected in a sterile milk sample bottles and pre-warmed at 40^0 C before analysis. The fat corrected (7%) milk yield was calculated by using following formula given by Raafat and Saleh (1962).

$$7\ \%\ \text{FCM (kg)} = (0.265 \times \text{milk yield in kg}) + (10.5 \times \text{fat yield in kg})$$

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Somatic Cell Count (**SCC×10^5 / ml of Milk**)

SCC of milk was calculated by DeLaval optical cell counter (Made in Sweden, Serial No. 10063, Manufacturing No. 70011176) by using stained cassette with a DNA specific fluorescent reagent.

Feed Efficiency

In the last week of the experiment a digestibility trial of seven days duration was conducted by total collection method. Four animals from each group were used for the trial. The animals were tied separately with sufficient space to avoid eating of feed/fodder of each other. During trial period, daily intake of the concentrate mixture and roughage was recorded individually. Total quantity of dung voided during 24 hours period by individual animal was recorded. Daily 1/200th part of faces voided by each animal was oven dried to constant weight for moisture estimation and the pooled dried samples for seven days were used for proximate analysis. Daily 1/400th part of total fecal matter was preserved, animal wise, for nitrogen estimation. The fecal samples for nitrogen estimation were preserved in Sulfuric acid (5 % w/v) used at the rate of 10 ml/50 gm of fecal sample and animal wise pooled samples were used for crude protein estimation.

Economics

The economics of milk production was calculated on the basis of input costs and daily return from the sale of milk.

Statistical Analysis

Observations of various parameters recorded during experimental period were tabulated and data were statistically analysed as per Snedecor and Cochran (1994) by using Web Agri Stat Package (WASP-2) software.

Results and Discussion

DMI, Feed Efficiency and Milk Production

The present research indicated that the dietary Se or vitamin E and their combination had no significant effects among the treatment groups T_0, T_1, T_2 and T_3 on the DMI, milk production, FCM and feed efficiency in terms of DMI, TDN and DCP intake per kg FCM of the dairy buffaloes. The results supported the general view that the dietary Se source was unlikely to markedly affect either feed consumption or milk yield (Juniper *et al.*, 2008). Gong *et al.* (2014) also reported non-significant effect on DMI and milk yield in dairy cows supplemented with Se @ 0.3 mg/kg DM intake. The non-significant effect of supplementation on DMI and milk yield may be attributed to sufficient level of Se and vitamin E in all the groups as the animals were fed well balanced ration. The well-known protective role of both the micronutrients predominantly observed in antioxidant status of animals. However, Moeini *et al.* (2009) reported non-significant effect on

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DM intake while significant increase in milk yield in Se and vitamin E supplemented groups in Holstein cows.

Milk Composition

In milk composition, the milk protein, fat and milk total solids showed no significant change. Similar results were reported by Juniper *et al.* (2008) who observed non-significant effect of Se supplementation on milk composition. However, milk SNF percentage (Table 4 and Fig. 1) were significantly (P<0.05) higher in T_3 group supplemented with Se and vitamin E. Likewise, the average milk lactose percentage (Table 4 and Fig. 2) significantly ($P \leq 0.01$) higher values in T_3 group than T_0, T_1 and T_2 groups. The similar view was shared by Eulogio *et al.* (2012), who reported significantly (P<0.05) higher milk SNF and lactose percentage in the Se and vitamin E supplemented group in dairy cows.

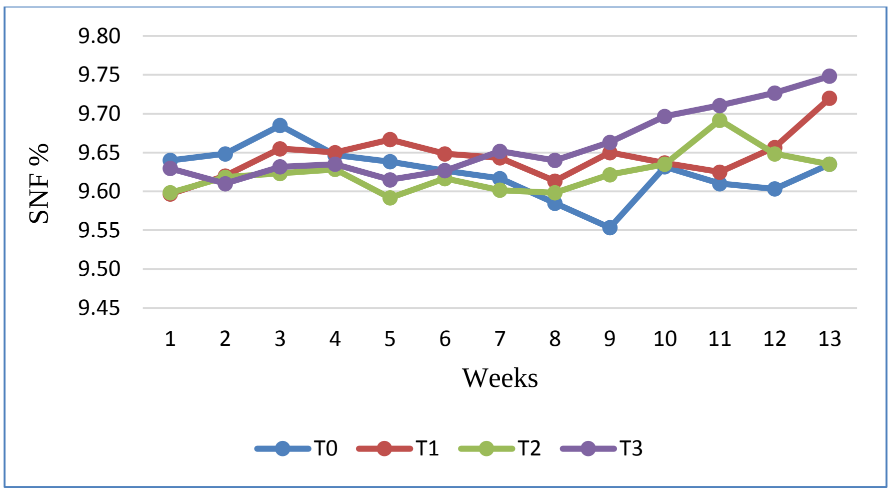

Fig. 1: Weekly average milk SNF percentage

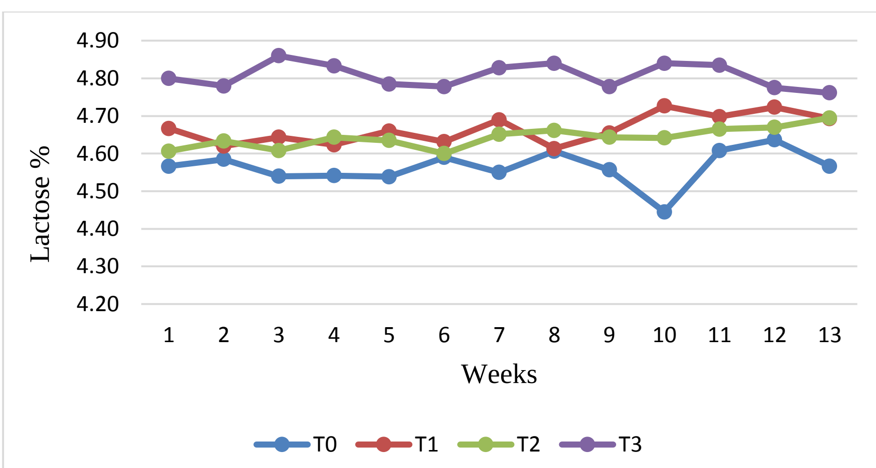

Fig. 2: Weekly average milk lactose percent

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Table 4: Overall performances of buffaloes from the experimental groups

Parameters	Groups				Result of 'CRD' test
	T_0 (control)	**T_1**	**T_2**	**T_3**	
Dry matter intake (kg)	15.71±0.080	15.77±0.134	15.70±0.090	15.95±0.149	NS
TDN intake (kg)	10.42±0.053	10.49±0.089	10.51±0.061	10.63±0.100	NS
DCP intake (kg)	1.17±0.006	1.19±0.010	1.17±0.007	1.20±0.011	NS
Milk Yield (kg)	10.35±0.025	10.37±0.044	10.34±0.019	10.36±0.018	NS
FCM yield (kg)	10.89±117	10.90±099	10.93±104	10.94±0.015	NS
DM intake/ kg FCM	1.444±0.012	1.447±0.003	1.437±0.017	1.458±0.012	NS
TDN intake/ kg FCM	0.958±0.008	0.963±0.002	0.962±0.011	0.972±0.008	NS
DCP intake/ kg FCM	0.108±0.001	0.109±0.000	0.107±0.001	0.110±0.001	NS
Milk Protein %	3.54±0.008	3.52±0.003	3.54±0.011	3.53±0.009	NS
Milk Fat %	7.49±0.050	7.51±0.037	7.52±0.062	7.52±0.017	NS
Milk SNF %	9.62^{b}±0.009	9.64^{ab}±0.008	9.62^{b}±0.007	9.66^{a}±0.0125	*
Total solid %	17.12±0.046	17.15±0.043	17.14±0.059	17.18±0.024	NS
Lactose %	4.56^{a}±0.012	4.67^{b}±0.010	4.64^{b}±0.007	4.81^{c}±0.009	**
Somatic cell count (SCC × 105/ ml milk)	3.36^{a}±0.033	2.90^{a}±0.200	3.27^{a}±0.164	2.00^{b}±0.367	**
Economics					
Experimental Groups		**T_0**	**T_1**	**T_2**	**T_3**
Total expenses (Rs/day)		211.3	212.8	207.39	213.52
Total cost of FCM production (Rs/kg)		19.4	19.52	18.97	19.52
Daily profit from per kg FCM yield (Rs/kg)		35.72	35.68	35.59	35.55

NS-Non- significance - $P \leq 0.05$; ** - $P \leq 0.01$; [abc] Means different superscripts in a row differ significantly.*

Milk Somatic Cell Count (SCC × 10^5 per ml)

The weekly average milk SCC of buffaloes from all experimental groups are presented in Table 4 and Fig. 3. The results showed that the treatment T_3 had significantly (P≤0.01) decreased SCC of milk compared to control, T_1 and T_2. The result of the present study is in agreement with Moeini *et al.* (2009) who noted significantly ($P < 0.05$) decreased SCC in Se and vitamin E supplemented group compared with controls. The reported effect of Se and vitamin E supplementation on SCC in the present study may be due to consistently improved selenoenzyme *i.e.* glutathione peroxydase activity and neutrophil function. The anti-infective function of neutrophils evident as they are the first line of defense after a pathogen invades the body. In contrast, Bourne *et al.* (2008) reported that supplementation of Se and vitamin E had no effect on SCC.

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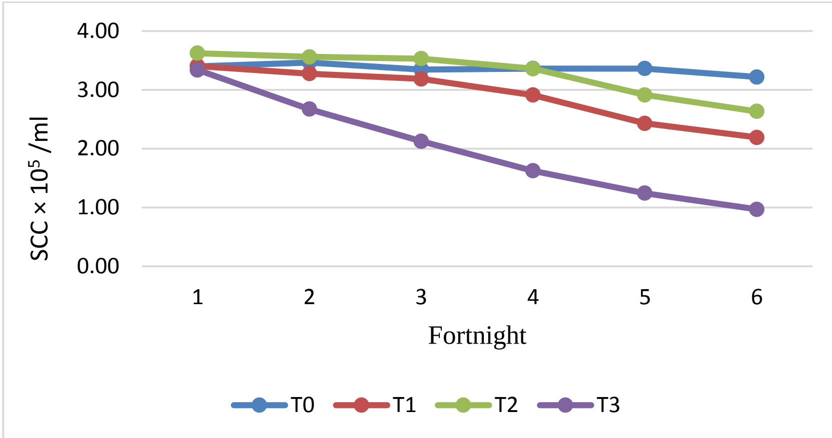

Fig. 3: Fortnightly milk average somatic cell count (SCC × 10^5 / ml)

Economics

The total cost of feeding per buffalo has little variation as the feed ingredients were not altered in the ration. The total cost and daily profit per kg FCM yield of control and treatment groups also indicated negligible difference.

Conclusion

The supplementation of Se @ 0.3 mg/kg DMI along with vitamin E 40 IU/kg DMI significantly decreases the milk SCC and improves SNF and lactose in milk of dairy buffaloes. It also indicated no effect on DMI, milk yield and feed efficiency in lactating buffaloes. Thus, it is feasible to incorporate Se and vitamin E in the dairy ration to prevent or mitigate subclinical infections and improve milk quality without affecting the feed digestibility and production performance in lactating animals.

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