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Effect of Area Specific Mineral Mixture Supplementation on Milk Yield and Milk Quality in Dairy Animals of Sub-mountainous Zone of Punjab

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ABSTRACT

The present study was carried out to evaluate the effect of mineral supplementation on milk yield and milk quality of dairy animals in Sub-mountainous zone of Punjab. Area specific mineral mixture was fed to lactating cattle and buffaloes of Hoshiarpur and Nawanshahar districts for 3 months at a constant dose rate of 50 g/animal/day and its effect on milk yield and its quality was analyzed at 3rd month post-treatment (last day of feeding of mineral mixture) and one month after cessation of the feeding of mineral mixture. Supplemented animals showed significant increase in milk yield as compared to un-supplemented group of animals, whereas, no significant difference was observed in milk components between the supplemented and un-supplemented groups.

Keywords: Area specific mineral mixture, buffaloes, cattle, milk components, milk yield

Punjab is the major contributor to the dairy sector in national economy. A significant number of animals in Central districts and Kandi area of the state suffer from mineral imbalances causing huge economic losses (Randhawa, 1999; Singh, 2002). Animals should receive the required quantities of feedstuffs providing all nutrients in proper proportion for optimum productive and reproductive efficiency. But, there was an acute shortage of forages in Kandi area and animals were under-fed in terms of macronutrients and micronutrients (Hundal *et al.,* 2009). Importance of minerals in regulating biological systems, growth, production and reproduction is well documented (McDowell *et al.,* 1984). Due to their increased requirement for lactation, dairy cows are more prone to mineral deficiencies (McDowell *et al.,* 1983). As far as Punjab is concerned, a significant number of animals in various districts of the state suffer from micro-mineral imbalance (Singh, 2002; Chhabra, 2006). Previous studies (Randhawa, 1999; Singh, 2002) have reported that majority of the animals in Central districts and Kandi belt of the state suffer from mineral imbalances causing huge economic losses.

Earlier studies revealed increase in milk yield as a result of supplementation of area specific mineral mixture in various states like Haryana (Sharma *et al.,* 2002; Sharma *et al.,* 2003) and Uttarakhand (Tiwari *et al.,* 2012). The purpose of this study was to assess the effect of area specific mineral mixture on milk yield and milk components of dairy animals of Sub-mountainous zone (Kandi area) of Punjab.

MATERIALS AND METHODS

Ethical Approval

The present study complies with the guidelines laid down by the institutional ethical committee.

Experimental design

67 animals (19 cattle and 48 buffaloes) were fed area specific mineral mixture @ 50g/animal/day for 3 months. 15 animals (3 cattle and 12 buffaloes) were kept as control group. All animals were within 0-4 months of lactation stage.

Tests and procedures

Fresh milk samples were collected from each selected animal on day 0 and 90 of feeding and one month after the cessation of mineral supplementation. All samples were analyzed for milk components using Lactoscan. For Milk Urea Nitrogen (MUN) estimation, 5 ml of milk sample was treated with 5 ml of 24 percent Tri Chloro Acetic Acid (TCA) reagent, mixed well and kept in stand for 5 minutes and centrifuged @ 3000 rpm for 10 minutes. Equal amounts of centrifuge and P-DMAB (4-Dimethylaminobenzaldehyde) reagent were taken and mixed and waited for 20 minutes. Optical density was recorded at 435 nm using Spectrophotometer. Milk yield was recorded on the basis of owner's history, which was the average milk yield of that lactation.

Statistical analysis

Mean, standard error of mean and range of various parameters were estimated and test of significance (2-way split analysis of variance and Fischer's exact test) between different groups were performed using SPSS for Windows (version 16.0; Microsoft).

RESULTS AND DISCUSSION

Effect on milk yield

Cattle

In cattle of treatment group, significant increase was observed in milk yield during the first 90 days of the trial, whereas after the cessation of mineral feeding from 90th to 120th day non- significant fall was recorded (Table 1). In cattle of control group, no significant change in milk yield was recorded (Table 2). However, no significant difference with time, treatment or time-treatment interaction was observed between the treatment and control groups on statistical comparison (Table 3). Similar to the present findings, Hackbart *et al.* (2010) observed increase in milk production at 14 week supplementation of organic trace minerals to cattle.

Buffaloes

Non-significant changes were observed in milk yield of buffaloes of both treatment (Table 4) and control group. On statistical comparison, significant effect of only time was evident from the present study. Khare and Bhagel (2010) reported increase in milk yield of mineral mixture supplemented dairy animals by 0.29l/day and decrease in unsupplemented animals by 0.43l/day during the course of trial, however, the difference between the treatment was reported to be non-significant. Also Boland (2003) observed significant increase in milk yield in treatment group supplemented with trace minerals as compared to control group of animals.

Effect on milk components

Cattle

No significant difference in Milk fat, lactose, solid not fat, protein and milk urea nitrogen was found in either control or treatment group of cattle (Tables 2 and 1). Statistical comparison also revealed no significant change in milk components with respect to treatment, time or treatment-time interaction (Table 3).

Buffaloes

In control group, no significant change was observed in milk components, whereas, in treatment group, buffaloes showed significant increase in mean milk fat levels on 90th and 120th days as compared to 0 day of the trial (Table 4). Also significant decrease was seen in milk SNF and MUN levels from 0 to 90th day of the trial and the mean level then showed increase from 90th to 120th days of the trial in both the components (Table 4). On statistical comparison, no significant change was observed in milk component values with regard to time, treatment or time-treatment interaction.

Similar to the present findings, Wu *et al.* (2000); Rabiee *et al.* (2010) and Begum *et al.* (2010) observed no significant difference in Milk protein, Milk lactose, Milk fat and Milk SNF between the supplemented and non-supplemented groups of animals.

CONCLUSION

The results indicated significant increase in milk yield of dairy animals on mineral supplementation with no significant improvement in milk components.

Table 1: Changes in Milk yield, Milk components and Milk Urea Nitrogen in cattle Treatment group (Mean±S.E.)

	Control Group			Treatment Group		
Parameter	**Day 0**	**Day 90**	**Day 120**	**Day 0**	**Day 90**	**Day 120**
Milk Yield (L/day)	6.17 ± 0.73 ^{p}	5.50 ± 0.76 ^{p}	5.17 ± 0.60 ^{p}	6.53 ± 0.71 ^{a}	8.05 ± 0.45 ^{b}	7.64 ± 0.43 ^{b}
Milk Lactose (%)	4.61 ± 0.25 ^{p}	4.63 ± 0.19 ^{p}	4.67 ± 0.34 ^{p}	4.67 ± 0.09 ^{a}	4.69 ± 0.12 ^{a}	4.60 ± 0.13 ^{a}
Milk Protein (%)	2.93 ± 0.40 ^{p}	2.90 ± 0.38 ^{p}	3.04 ± 0.48 ^{p}	3.25 ± 0.07 ^{a}	3.32 ± 0.07 ^{a}	3.27 ± 0.08 ^{a}
Milk Fat (%)	3.70 ± 0.22 ^{p}	2.67 ± 0.33 ^{p}	3.47 ± 0.32 ^{p}	3.67 ± 0.28 ^{a}	3.96 ± 0.23 ^{a}	3.90 ± 0.24 ^{a}
Milk SNF (%)	8.61 ± 0.22 ^{p}	8.53 ± 0.48 ^{p}	8.67 ± 0.30 ^{p}	8.67 ± 0.20 ^{a}	8.68 ± 0.20 ^{a}	8.54 ± 0.19 ^{a}
MUN (mg/dl)	5.01 ± 0.36 ^{p}	4.97 ± 0.43^{p}	5.07 ± 0.34 ^{p}	6.18 ± 0.28 ^{a}	6.25 ± 0.26 ^{a}	6.27 ± 0.27 ^{a}

Values with common superscripts in a row do not differ significantly ($p > 0.05$)

Table 2: Comparative changes in Milk yield, Milk components and Milk Urea Nitrogen in cattle over duration of the trial (Mean±S.E.)

Parameter	Group	Day 0	Day 90	Day 120	Sig.
Milk Yield (L/day)	Treatment (n= 19)	6.53 ± 0.71	8.05 ± 0.45	7.64 ± 0.43	T
					Txt
	Control (n= 3)	6.17 ± 0.73	5.50 ± 0.76	5.17 ± 0.60	T
Milk Lactose (%)	Treatment (n= 19)	4.67 ± 0.09	4.69 ± 0.12	4.60 ± 0.13	T
					Txt
	Control (n= 3)	4.61 ± 0.25	4.63 ± 0.19	4.67 ± 0.34	T
Milk Protein (%)	Treatment (n= 19)	3.25 ± 0.07	3.32 ± 0.07	3.27 ± 0.08	T
					Txt
	Control (n= 3)	2.93 ± 0.40	2.90 ± 0.38	3.04 ± 0.48	t
Milk Fat (%)	Treatment (n= 19)	3.67 ± 0.28	3.96 ± 0.23	3.90 ± 0.24	T
					Txt
	Control (n= 3)	3.70 ± 0.22	2.67 ± 0.33	3.47 ± 0.32	t
Milk SNF (%)	Treatment (n= 19)	8.67 ± 0.20	8.68 ± 0.20	8.54 ± 0.19	T
					Txt
	Control (n= 3)	8.61 ± 0.22	8.53 ± 0.48	8.67 ± 0.30	t
MUN (mg/dl)	Treatment (n= 19)	6.18 ± 0.28	6.25 ± 0.26	6.27 ± 0.27	T
					Txt
	Control (n= 3)	5.01 ± 0.36	4.97 ± 0.43	5.07 ± 0.34	t

Where Sig. = Significance, T = Treatment, Txt = time-treatment interaction and t = time, *= Significance ($p \leq 0.05$).

Table 3: Changes in Milk yield, Milk components and Milk Urea Nitrogen in buffaloes Treatment group (Mean ± S.E.)

	Control Group			Treatment Group		
Parameter	**Day 0**	**Day 90**	**Day 120**	**Day 0**	**Day 90**	**Day 120**
Milk Yield (L/day)	5.08 ± 0.66 ^{p}	6.00 ± 0.37 ^{p}	5.58 ± 0.42 ^{p}	5.52 ± 0.35 ^{a}	7.71 ± 0.30 ^{a}	7.35 ± 0.26 ^{a}
Milk Lactose (%)	4.32 ± 0.21 ^{p}	4.24 ± 0.20 ^{p}	4.33 ±0.22 ^{p}	4.65 ± 0.08 ^{a}	4.60 ± 0.09 ^{a}	4.65 ± 0.09 ^{a}
Milk Protein (%)	3.07 ± 0.15 ^{p}	2.98 ± 0.16 ^{p}	3.02 ± 0.16 ^{p}	3.28 ±0.06 ^{a}	3.23 ±0.06 ^{a}	3.29 ±0.06 ^{a}
Milk Fat (%)	5.25 ± 0.65 ^{p}	4.90 ± 0.51 ^{p}	5.19 ± 0.56 ^{p}	6.04 ± 0.46 ^{a}	6.84 ± 0.38 ^{b}	7.02 ± 0.37 ^{b}
Milk SNF (%)	8.26 ± 0.39 ^{p}	8.25 ± 0.40 ^{p}	8.31 ± 0.40 ^{p}	8.98 ± 0.17 ^{b}	8.81 ± 0.17 ^{a}	8.92 ± 0.18 ^{c}
MUN (mg/dl)	6.17 ± 0.65 ^{p}	6.09 ± 0.63 ^{p}	6.17 ± 0.65 ^{p}	6.69 ± 0.26 ^{a}	6.63 ± 0.20 ^{b}	6.78 ± 0.18 ^{b}

Values with common superscripts in a row do not differ significantly ($p > 0.05$)

Table 4: Comparative change in Milk yield, Milk components and Milk Urea Nitrogen in buffaloes over duration of the trial (Mean± S.E)

Parameter	Group	Day 0	Day 90	Day 120	Sig.
Milk Yield (L/day)	Treatment (n= 48)	5.52 ± 0.35	7.71 ± 0.30	7.35 ± 0.26	T Txt t*
	Control (n=12)	5.08 ± 0.66	6.00 ± 0.37	5.58 ± 0.42	
Milk Lactose (%)	Treatment (n= 48)	4.65 ± 0.08	4.60 ± 0.09	4.65 ± 0.09	T Txt t
	Control (n= 12)	4.32 ± 0.21	4.24 ± 0.20	4.33 ± 0.22	
Milk Protein (%)	Treatment (n= 48)	3.28 ± 0.06	3.23 ± 0.06	3.29 ± 0.06	T Txt t
	Control (n= 12)	3.07 ± 0.15	2.98 ± 0.16	3.02 ± 0.16	
Milk Fat (%)	Treatment (n=48)	6.04 ± 0.46	6.84 ± 0.38	7.02 ± 0.37	T Txt t
	Control (n= 12)	5.25 ± 0.65	4.90 ± 0.51	5.19 ± 0.56	
Milk SNF (%)	Treatment (n=48)	8.98 ± 0.17	8.81 ± 0.17	8.92 ± 0.18	T Txt t
	Control (n= 12)	8.26 ± 0.39	8.25 ± 0.40	8.31 ± 0.40	
MUN (mg/dl)	Treatment (n=48)	6.69 ± 0.26	6.63 ± 0.20	6.78 ± 0.18	T Txt t
	Control (n= 12)	6.17 ± 0.65	6.09 ± 0.63	6.17 ± 0.6	

Where Sig. = Significance, T = Treatment, Txt = time-treatment interaction and t = time, *= Significance ($p \leq 0.05$).

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