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Effect of area specific mineral mixture feeding on productive and reproductive performance of dairy animals

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Abstract

The present study was conducted to evaluate the effect of area specific mineral mixture supplementation on the productive and reproductive performance of dairy animals. Mineral supplementation was done in lactating dairy cattle (n=40), selected randomly from four villages of the sub mountainous zone of Punjab. Treatment group (t) was fed with mineral mixture @ 60 gm/animal/day till 120 days of lactation period, whereas the control group (c) was not supplemented. Milk production parameters such as milk yield, milk fat %, milk solids not fat (SNF) %, milk protein%, and milk lactose % were evaluated between treatment and control group at an interval of 0 days, 60 days, and 120 days. Similarly, reproductive performance traits such as conception rate, service per conception, service period, and days of first postpartum estrus were also recorded at the same interval between these groups. The results of the study indicated a significant increase in milk yield in the treatment group, whereas no significant difference was observed in the milk composition. In terms of reproductive performance, the first postpartum estrus and conception rate were found to significantly differ between treatment and control groups. These findings may suggest that supplementation of mineral mixture enhanced the productive and reproductive performance of dairy animals.

Keywords: Area-specific mineral mixture, cattle, production, reproduction

Introduction

India has the largest bovine population in the world and ranks first in milk production (176.3 million) during 2017-18 recording a growth of 6.65% ^[1]. The per capita milk availability in the country is 374 gram/day which is much more than the world average consumption of milk 294 gram/day ^[1]. However, per animal productivity is very low in the country is mainly due to poor genetic makeup along with compromised nutritional status of the dairy animals which leads to various metabolic disorders and reproductive inefficiencies such as anestrus, repeat breeding, and infertility ^[2]. Hence, balanced nutrition is very essential for maintaining good body condition score (3 to 3.5) which renders them enhancing the production and reproduction efficiency of dairy animals. Mineral deficiency in dairy animals is the foremost cause of poor growth rate, suppress body immunity, decreased milk yield, and various reproductive disorders ^[3]. During the past decade, significant research has been conducted for understanding the effect of macro/micro mineral supplements on the production efficiency in dairy animals ^[4, 5]. Various minerals are being depleted gradually in soil and grown fodder which reflect in dairy animals as deficiency syndrome of that particular mineral ^[6]. Hence, the quantity of minerals present in fodder/grasses may not be adequate for optimal growth, production, and reproduction performances, when fed to dairy animals ^[4]. In the sub-mountainous zone of Punjab popularly known as the *Kandi* area, dairy cows suffer from mineral imbalances causing huge economic losses ^[7, 8]. To date, data regarding the role of area specific mineral mixture supplementation on production and reproduction efficiency in dairy animals is scanty/limited. Hence, the present study was conducted to observe the impact of supplementation through feeding of area specific mineral mixture on the production and reproduction efficiency of dairy animals in the sub-mountainous zone of Punjab.

Materials and Methods

Geographical location

The experimental study was carried out in crossbred cattle ($n=40$), selected randomly from four villages of the sub mountainous zone (Kandi region) of Nawanshahr district of Punjab. This zone is located between $30^{\circ}44'$ and $32^{\circ}32'$ N latitude and $75^{\circ}52'$ and $76^{\circ}43'$ E longitude at an elevation of 300-500 m above mean sea level.

Experimental animals

The total animals ($n=40$) were divided into two groups (treatment vs. control) having 20 animals in each group. Animals from the treatment group ($n=20$) were fed area specific mineral mixture (ASMM) at the rate of 60 gram/animal/day for 4 months, whereas animals from the control group were not given any supplementation. Feeding practices by farmers were similar in both the group except the supplementation of ASMM in the treatment group only. Production and reproduction data were collected from day one till 120 days of lactation. Production parameters, such as milk fat (%), milk SNF (%), milk protein (%), and milk lactose (%) were measured fortnightly from 0 days to three months. Similarly, reproductive parameters such as first postpartum estrous (days), service per conception, service period, and conception rate (%) was recorded in the treatment and control group of animals.

Statistical analysis

The statistical analysis was done by SPSS (version 16.0) and a one-way analysis of variance (GLM) with comparison among means was made by Duncans multiple range [9] and post hoc test with a significance level of $P \leq 0.05$.

Results and Discussion

Effects on Milk yield

Milk production parameters of dairy cattle in the treatment and control group have been presented in table 1. Daily milk production was found to differ significantly ($P \leq 0.05$), between the treatment (11.01 ± 0.41^b) and control (9.24 ± 0.10^a) group. Similar findings were also observed by [10, 11] an increase in milk production in dairy animals during the 13-week supplementation of area specific mineral mixture. Tiwari et al. [12] and Hackbart et al. [13] showed that the after supplementation of area specific mixture and organic trace minerals to animals, which were associated with increased milk production. Moreover, enhancing milk production was observed during the second lactation as compared to the first lactation after mineral supplementation [14]. The present results might be indicating that feeding of mineral mixture enhanced milk production due to the action of macro/micro/trace minerals, by stimulating the basket cells or myoepithelial cells of the udder.

Effects on milk components

No significant differences were observed in milk fat (%), milk protein (%), milk lactose (%), and milk SNF percentage between treatment and control groups in dairy cattle (table 1). Similar findings were also reported by Singh et al. [15], there were no significant differences between treatment and control groups in milk components (milk fat, milk protein, lactose, and SNF). In addition, Wu et al. [16], Rabiee et al. [17], and Begum et al. [18] observed that dietary supplementation of phosphorus and organic trace minerals to dairy animals, which can support high milk production but there were no significant differences of milk components in the

supplemented group.

Effects on reproductive performance

Reproductive traits i.e. Post-partum estrus, service period, number of A.I/conception, and conception rate were also recorded during the experimental period as shown in table 2. These reproductive traits significantly ($P \leq 0.05$) differed in the treatment group of dairy animals with the control group. The supplemented group of animals voluntary waiting period (42.53 ± 2.06 days) was observed slightly lower than the control group (63.42 ± 2.38 days). On average onset of first postpartum estrus was observed to occur 20.89 days earlier in the ASMM group as compared to control. Moreover, the mineral mixture fed group with a service period (73.59 ± 1.91^a days) was also found significantly ($P \leq 0.05$) lower than the control group (90.61 ± 2.07^b). Similar findings were also reported by Devasenat et al. [19], Puvajaran and Vijayarajan, [20], Sahoo et al. [21], and Srivara and Bhuvanewari, [22], there was a significant difference of reproductive parameters (first post-partum estrus, service period, and a number of AI/conception) between mineral mixture supplemented and no supplemented group in dairy animals.

Table 1: Effect of mineral mixture feeding on milk production parameters in dairy crossbred cattle

Parameters	Group	Day 0	0-2 months	2-4 months
Milk yield (lt./day)	Treatment	9.63±0.13 ^a	11.25±0.32 ^b	11.01±0.41 ^b
	Control	9.31±0.16 ^a	10.05±0.11 ^a	9.24±0.10 ^a
Milk Fat %	Treatment	3.57±0.24	3.82±0.12	3.77±0.10
	Control	3.62±0.30	2.89±0.43	3.46±0.21
Milk protein %	Treatment	3.18±0.51	3.42±0.32	3.12±0.14
	Control	3.10±0.12	2.87±0.44	3.22±0.21
Milk Lactose %	Treatment	4.73±0.03	4.82±0.32	4.61±0.01
	Control	4.52±0.33	4.35±0.11	4.60±0.11
Milk SNF%	Treatment	8.87±0.23	8.40±0.03	8.66±0.35
	Control	8.52±0.49	8.71±0.27	8.47±0.08

Figures in a row having different superscripts are significantly different from each other ($p < 0.05$)

Table 2: Effect of mineral mixture feeding on reproductive parameters in dairy crossbred cattle

Parameters	Treatment	Control
First postpartum estrous (days)	42.53±2.06 ^a	63.42±2.38 ^b
Number of AI /conception	1.83±0.52	1.72±1.34
Service period (days)	73.59±1.91 ^a	90.61±2.07 ^b

Figures in a row having different superscripts are significantly different from each other ($p < 0.05$)

Conclusions

This study impeding a fact that supplementation of area specific mineral mixture in dairy animals improved their productive performances viz., Increase of milk yield and reproductive performances viz., reduced onset of postpartum estrus, and decreases of the service period. Hence, supplementation of mineral mixture would be able to improve the production status of dairy animals and could make them more reproductive sound which will eventually enhance the income of dairy stakeholders and farmers' economic condition.

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