



Effect of Chelated Minerals Supplement on Milk Yield and Composition of Sahiwal and Haryana Cows

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ABSTRACT

Background: The study was carried out at the Dairy farm of Banaras Hindu University, Dist. Varanasi (Uttar Pradesh). Twelve (12) Sahiwal and Haryana cows ranging 4 - 6 years of age was randomly selected for present investigations. Animals were stratified for their initial body weight and age. The objective of the study was to compare the effect of feeding chelated mineral based formulation on dairy cow production performance, namely milk yield and milk composition.

Methods: The trial was conducted with dairy cows 3 - 4 months of lactation. The experimental treatments included: Fedamin (Chelated minerals, given 50 gm. /day/ cow) and control. The study lasted from 0 to 30 days. Milk yield and milk composition of cows were measured individually on days 1, 8, 15, 22 and 30.

Result: The Fedamin treated group (Chelated minerals) improved the milk yield and fat percentage in milk during this study as compared to control and specific gravity, solid-not fat, protein, lactose and total solids of milk differ non-significantly.

Key words: Chelated minerals, Milk composition, Milk yield, Trace minerals.

INTRODUCTION

Bovine milk production is partially dependent on the cow's mineral nutrition. When a cow is deprived of optimum amounts of essential minerals necessary for milk production, the system will initially cannibalize its own body stores. Once those mineral reserves are depleted, milk production will decline more rapidly than would be predicted in a normal milking cycle in which adequate mineral nutrition is provided. Chelated trace minerals are bound to organic ligands through coordinate covalent bonds. The bonds between the ligand and the mineral can prevent the mineral from interacting with antagonists and improve the bioavailability of the mineral (Ward *et al.*, 1996; Bailey *et al.*, 2001). Trace minerals helps in improving the reproductive performance of cattle (Kumar *et al.*, 2011; Grace and Knowles, 2012). Chelated minerals is a mixture of Ca, P, Zn, S, Mn, Na, K, Mg, Fe, I, Co, Cu etc. macro and micro minerals combined with a mixture of amino acids and peptides (NRC, 2001). Micro elements are important for reproductive health (Chester-Jones *et al.*, 2013). These chelated minerals are thought to be more digestible than non-chelated forms. In other words, chelation makes the minerals more bioavailable (able to be absorbed and used for bodily functions), chiefly by shielding them from the effects of other dietary elements in the animal's digestive tract. Optimum concentration of micro minerals helps in achieving higher conception rates (Rabiee *et al.*, 2010). If macro minerals like calcium deficiency occur, it causes decreased muscle contraction which in turn leads to reduced feed intake as rumen function disturbance and hence leading to severe Negative Energy Balance (NEB). As a result mobilization of fat increases which in turn causes fatty liver syndrome and ketosis (Boland

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et al., 2001). This will lead to impair fertility and decrease in milk production.

The objective of the study was to determine the effects of supplementation of chelated minerals Fedamin of Guybro Animal Health Private Limited, Mumbai, feeding on milk production and milk composition in dairy cows. Fedamin is an elite group of chelated minerals. Nutritional composition of chelated minerals is furnished in Table 2. It contains a combination of 12 minerals (Co, Cu, I, Fe, Mg, K, Na, Mn, S, Zn, Ca and P) with 4 vitamins (Vitamin A, B₃, D₃, E,) which helps to overcome deficiency in ration and helps in increase of milk production.

MATERIALS AND METHODS

The trial was conducted at the dairy farm of the Department of Animal Husbandry and Dairying, Institute of Agricultural

Sciences, Banaras Hindu University Dist. Varanasi (Uttar Pradesh). For this study 12 (Twelve) Sahiwal and Haryana lactating cows were randomly selected in such a way that all the animals from each of the 3 - 4 months of lactation stage. The selected cows from each of the lactation period were divided in such a way that each group consists of 6 cows.

Fedamin was administered orally to the cows at the rate of 0 and 50 gm/day/animal for 30 days for group I & II respectively. The milk samples and yield of individual cows was noted before the commencement of the treatment as well as on 1th, 8th, 15th, 22th and 30th day of the commencement of the treatment. On each of the milk-recording day the milk sample was subjected for the analysis of specific gravity, fat %, SNF %, total solids %, Protein % and lactose %, to find out the economic traits of the milk. Milk samples for chemical analysis were prepared as per the method described in BIS Handbook (SP 18: 1981).

In this experiment, concentrate feed mixture was used, consisting of 33% maize, 21% groundnut cake (oiled), 12% mustered cake (oiled) 20% wheat bran, 11% de-oiled rice bran, 2% mineral mixture and 1% common salt.

Milk Composition Analysis

Specific gravity

Specific gravity is measured by Lactometer. The specific gravity was calculated by the following formula:

$$\text{Specific gravity} = \frac{\text{CLR}}{1000} + 1$$

Where,

CLR= Lactometer reading (LR) ± Correction factor (CF)

CF = 0.1 × Difference between temperature of milk and calibration temperature of Lactometer

Determination of fat

The fat content of milk was determined by Gerber method. Fat content (colourless column) was measure directly from the butyrometer stem by deducting lowest figure from highest as described in IS: 1224 (Part-I), 1977.

Determination of SNF (solids-not-fat)

The specific gravity of milk will, therefore, vary with the duration and temperature of storage. This variation may be overcome by ensuring that the fat is completely in the liquid state before the specific gravity reading is taken. This is achieved by pre-warming the milk.

The % of SNF in milk is calculated using the following formula:

$$\text{SNF (in\%)} = \frac{\text{CLR}}{4} + 0.25F + 0.44$$

Where,

F = Fat content of milk.

SNF = Solids-not-fat in milk;

CLR = Corrected lactometer reading at 27°C,

Determination of milk protein

The milk protein content of all the milk samples of milk were determined using micro-Kjeldahl method of nitrogen

estimation as described in BIS Handbook (SP 18: part XI, 1981). The percent total protein was obtained multiplying the percent nitrogen by a factor of 6.38.

Calculation:

Calculate the total nitrogen content of the test sample by the following equation:

$$\text{Total N} = \frac{1.4007 (V_s V_b) \text{ Mr}}{W}$$

Where,

Vs = Volume of standard acid used for titration of test sample (ml).

Vb = Volume of standard acid used for titration of blank sample (ml).

Mr = Exact concentration of standard acid used in titration (N).

W = Weight of sample used (g).

Determination of milk lactose

The lactose content of all the milk samples were determined using Lane Eynon Method described in BIS Handbook (SP 18: part XI, 1981).

$$\text{Lactose (\% by Weight)} = \frac{5X}{Y}$$

Where,

X = ml of 0.5% standard lactose solution used for titration.

Y = ml of lactose milk filtrate used for titration.

Total solids

The total solids content was determined by Gravimetric method. The total solid was calculated by the following formula as described in IS: 1479 (Part-II), 1961.

$$\text{Total solids \%} = \frac{\text{Weight of residue}}{\text{Weight of milk sample}} \times 100$$

Statistical analysis

The data obtained during investigation were subjected to statistical analysis using one-way ANOVA to compare differences among group's means for different parameters by using SPSS 16.0 software.

RESULTS AND DISCUSSION

Milk yield

Effect of supplementation of chelated minerals on milk yield is presented in Table 1. It is clearly indicated by the presented data that milk yield differed significantly by using supplementation of chelated minerals. The average milk yield was recorded higher in the treated group (8.24 kg/ d) as compared to the control group (7.50 kg/d). The average increase in milk yield was recorded 0.74 kg in a group fed with chelated minerals. This increase was recorded consistently throughout the whole experiment. Somkuwar *et al.* (2011) found that the Metho-chelated organic minerals treated group improved the milk yield of animals across the various stages of lactation as compared to in control and inorganic mineral treated groups of animals.

Table 1: Average milk yield (in kg.) and milk composition in different groups of cows receiving different treatments.

Component	Treatment	1 day	8 day	15 day	22 day	30 day	Average
Milk yield	Control	6.12±0.18	7.30±0.27	7.68±0.42	7.93±0.19	8.48±0.11	7.50
	Chelated mineral	5.26±0.23	5.64±0.34	8.75±0.21	9.84±0.13	11.74±0.45	8.24
Specific gravity	Control	1.030±0.007	1.030±0.003	1.028±0.007	1.030±0.005	1.030±0.002	1.0296
	Chelated mineral	1.030±0.008	1.029±0.006	1.029±0.003	1.028±0.006	1.029±0.004	1.029
Fat	Control	3.38±0.22	3.51±0.17	3.95±0.35	4.78±0.45	4.79±0.23	3.68
	Chelated mineral	4.20±0.39	4.28±0.29	4.37±0.26	4.76±0.24	4.95±0.29	4.51
Solid-not fat	Control	9.17±0.11	9.61±0.12	9.56±0.15	9.75±0.15	9.83±0.16	9.58
	Chelated mineral	8.66±0.21	7.87±0.13	7.93±0.15	8.73±0.22	8.77±0.29	8.39
Protein	Control	3.42±0.12	3.40±0.21	3.56±0.29	3.61±0.17	3.70±0.22	3.53
	Chelated mineral	3.15±0.19	3.33±0.23	3.56±0.27	3.77±0.33	3.73±0.14	3.50
Lactose	Control	4.63±0.11	4.70±0.23	4.78±0.32	5.10±0.35	5.08±0.18	4.85
	Chelated mineral	4.51±0.25	4.69±0.31	4.70±0.12	5.03±0.22	5.11±0.14	4.80
Total solid	Control	13.45±0.25	13.84±0.34	13.75±0.14	13.01±0.31	13.33±0.11	13.47
	Chelated mineral	13.72±0.42	13.35±0.33	14.01±0.23	13.38±0.41	12.70±0.32	13.43

Table 2: Nutritional Composition of 'Fedamin' chelated minerals (Values per kg.).

Ingredients	Amount (per kg)
Vitamin- A	700000 IU
Vitamin- D ₃	70000 IU
Vitamin- E	250 mg
Nicotinamide	1000 mg
Cobalt	150 mg
Copper	1200 mg
Iodine	325 mg
Iron	1500 mg
Magnesium	6000 mg
Potassium	100 mg
Sodium	5.9 mg
Manganese	500 mg
Sulphur	0.72%
Zinc	9600 mg
Calcium	25.5%
Phosphorus	12.75%

Specific gravity

The observation recorded for specific gravity of milk samples collected from different sources are furnished in Table 1. Non-significant variation was seen in the treated group for specific gravity. The average specific gravity in both groups was almost similar.

Milk fat (%)

Data pertaining to milk fat % is presented in Table 1. It is obvious from the data that average higher milk fat (4.51%) was recorded with the treatment group, whereas minimum milk fat (3.68%) was observed in the control group. The average significant increase in milk fat was recorded 0.83% in the treated group. Similar results have been reported when dairy cows were supplemented with chelated minerals (Formigoni *et al.*, 1993).

SNF (%)

The effect of supplementation of chelated minerals on SNF content of milk is shown in Table 1. It was seen from the findings of the experiment that higher average SNF content was recorded with the control group (9.58%) as compared to the treated group (8.39%). It is clearly indicated by the present findings that there is no effect of chelated minerals on the SNF content of milk. The same was significantly reduced as compared to control when chelated minerals were used in the diet at either level. However, the difference between the groups receiving chelated minerals was non-significant.

Protein (%)

The week wise average milk protein percentage from different groups are presented in Table 1. The average milk protein percentage was 3.50 and 3.53 respectively for the treatment and control group. Thus, the protein contents of milk from cows receiving chelated minerals was almost similar. The statistical analysis indicated non-significant effect of treatments on the protein content of milk. Kincaid *et al.*, (1984) reported that the milk protein percentage was not affected by supplementing Zn-methionine to the lactating cows. Similar trend was also noticed in the present trial.

Lactose (%)

Data concerning lactose content of milk as affected by chelated minerals are presented in Table 1. It is apparent from data that the control group contained higher lactose content (4.85%) as compared to the group supplemented with chelated mineral (4.80%). It is clearly indicated by the present findings no effect of supplementation of chelated minerals on lactose content in milk.

Total solids (%)

The week wise average total solids percentage of milk from different groups are presented in Table 1. It is evident from the table that the average total solids percent of milk was

13.43 and 13.47% for treated and control group respectively. Thus, the total solids percent in different groups was almost same. It is noticed that the treatments had non-significant effect on the total solids percent of milk from both groups.

CONCLUSION

The group of animals in stage of lactation receiving Fedamin chelated mineral supplement showed an increase in milk yield and fat percentage by 0.74 kg and 0.12% respectively over a treatment period of 30 days.

Keeping in view the research outcomes summarized above, it can be concluded that the chelated mineral supplement improves milk quality and quantity in terms of increased milk yield and milk fat. Whereas, there was no effect on solid-not-fat (SNF), protein, lactose and total solid content in milk. The above results are thus in agreement to the researchers that feeding of chelated minerals improves milk yield and fat percentage of the dairy cows.

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