*The Haryana Veterinarian* (December, 2024) **63(2),** 254-258 ISSN 0033-4359 (P) **Research Article**

# EFFECT OF MINERAL MIXTURE AND BYPASS FAT SUPPLEMENTATION ON FAT, SNF AND MILK YIELD IN LACTATING CATTLE

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## ABSTRACT

The study was done to evaluate the effect of feeding bypass fat along with mineral mixture and mineral mixture alone on fat, SNF content and milk yield of lactating crossbred cattle. Thirty lactating cows in their 2nd - 3rd lactation were selected for the trial in early lactation stage for sixty days. They were divided randomly into three groups each having 10 cows i.e. $T_0$ (control group) without feeding any mineral mixture and bypass fat, $T_1$ cows fed with mineral mixture @50 g/day and $T_2$ cows fed with bypass fat @100 g/day along with mineral mixture @ 50 g/day. Significant ($P<0.05$) difference in milk yield and fat content was noticed in cows fed bypass fat along with mineral mixture. Milk yield was found lowest in control group. The economic evaluation of supplementation of bypass fat and mineral mixture revealed significant ($P<0.05$) enhancement in daily profit. The benefit was estimated as Rs. 73.28, Rs.97.24, and Rs. 128.23 per animal/day with cost-benefit ratio of 1: 1.37, 1: 1.49 and 1: 1.59 in control, $T_1$ and $T_2$ group, respectively. The supplementation of bypass fat and mineral mixture enhances milk yield and fat percentage of lactating cattle which augment the incomes of the farmers.

**Keywords:** Bypass fat, Lactating cattle, Mineral mixture

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India ranks first in milk production with the contribution of 221 million tonnes (23 percent) in the world and total milk production at around 930 million tonnes (FAO, 2022). In the present scenario of small land holding size and increasing jobless surroundings dairy has become an important source of income and employment generation for millions of marginal farmers and farm women. Sale price of milk in milk co-operative depends on its fat and SNF content. Dairy farmers are benefited with the higher milk yield and more fat content (Parnerkar *et al.*, 2010). Cows in early phase of lactation are at a loss to put away sufficient energy as demand for good lactation from the feed eat willingly, it exceeds energy expenditure in comparison to intake. The negative energy balance metabolise body fat (Barley and Baghel, 2009). Beside this it may be the cause reduced milk yield, fatty liver, ketosis and inferior reproductive performance of the animal. Through strategic supplementation of energy with incorporation of fat in diet the productivity of lactating animal can be enhanced (Sirohi *et al.*, 2010). Dietary fat inclusion in ration enhance its energy density but the high extent of hydrolysis of the dietary fat in rumen may reduce fibre digestibility. Dietary fat that resists lipolysis and bio-hydrogenation in rumen by rumen micro-flora is known as rumen protected fat or bypass fat. It improves energy density of ration to meet the energy demand and fatty acid requirement of the animas to fetch milk production potential (Dhiman *et al.*, 1995). Bobe *et al.*, 2007 said that bypass fat does not affect rumen fermentation. It is absorbed in lower digestive tract and supplement energy to the animal for higher milk yield. Therefore, the trial was done to examine the effect of dietary addition of bypass fat on milk production, fat percentage and SNF content in lactating cattle.

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## MATERIALS AND METHODS

### A. Experimental design and feeding management

The trial was carried out at Krishi Vigyan Kendra, Arwal. Thirty lactating Jersey crossbred multiparous cows (2nd and 3rd lactation stage) in early lactation of 30 to 45 days were chosen on the basis of similar average milk yield for the study. The intensive farming system was adopted by the farmers. The feed offer to the cows per day were 5 Kg dry fodder, 1 Kg concentrate ration for maintenance and ad libitum green fodder. Beside this the production concentrate ration at the rate of 1 Kg/3L of milk yield was given to the lactating cows. The prepared concentrate mixture consists of broken wheat (44%), mustard cake (23%), maize (20%), bran (10%), mineral mixture (2%) and salt (1%). The animals were grouped in three categories (T0, T1 and T2) each have 10 animals. T0 act as control group and were given only the composed basal diet without any supplementation. T1 group of cows were supplemented with mineral mixture (Table 1) available from market @ 50 g/day along with the composed basal diet. T2 group of cows were given 100g bypass fat per day along with mineral mixture @ 50 g/day and composed basal diet. The study was carried out for

sixty days. Soni and Patel (2015) reported increase in milk yield through the addition of bypass fat @ 100 g/animal /day in diet.

**B. Sampling and analysis**

Milk production of lactating cows in both the morning and evening time were recorded for each cow at regular intervals of 5 days. Milk samples of each animal were analysed for fat and SNF content using Ultrasonic Lactoscan Milk Analyzer Machine (Essae) at milk co-operative centre. The milk production was rectified to 3.5% fat content (FCM) with the use of formula of Sklan *et al.* (1994). Milk yield and fat percentage of the milk were used to calculate 3.5% FCM by the formula, 3.5% FCM= milk yield x (0.432 +0.163 fat %). Economic analysis of respective outcome were done using total cost of production and gross return in each trail.

During calculation of total cost of production, different components namely cost of feed, cost of bypass fat, cost of mineral mixture, average milk production per day, milk production cost and per day earning with the sale of milk were considered. Cost of dry fodder, green fodder, and homemade concentrate mixture, bypass fat and mineral mixture comprised the total expenditure. The income entailed the sale of milk which was calculated by multiplying average milk yield (L/day) and average price per litre existing as per milk co-operative milk price schedule for producer during the period. The analysis of the different components was done by the outputs come from different trials.

The milk yield (L/day) and milk fat (percentage) at different lactation days in lactating cattle during experiment period were recorded. The data recorded for milk yield, fat and SNF content (Mean ± SE) of milk at different lactation days and overall were statistically analysed with online ICAR data analysis tools under randomized design using one way of analysis of variance (ANOVA).

## RESULTS AND DISCUSSION

Average milk yield of animals per day recorded during the different lactation periods is shown in Table 1. Average initial milk yield in control, mineral mixture supplemented and bypass fat with mineral mixture supplemented animals were 10.75±0.04, 10.80±0.04 and 10.81±0.04 L per day respectively on 5$^{th}$ day and it reached to a differential level of 9.78± 0.08, 11.40±0.08 and 12.20± 0.05L per day, respectively on 60$^{th}$ day of experiment. The milk yield of animals of control group produced maximum 11.06±0.04 L per day on 20$^{th}$ day of experiment and then began fall in milk production till the last day of the experiment period. The animals of T1 and T2 group supplemented with mineral mixture and bypass fat along with mineral mixture, respectively maintained the increase in milk production, reached the peak value 11.48±0.04 and 12.30±0.04 L per day on 50$^{th}$ and 40$^{th}$ day of experiment, respectively and almost remain as such till the 60$^{th}$ day of experiment. The milk fat content recorded during different lactation periods is shown in Table 2. Average initial milk fat content in control, mineral mixture supplemented and bypass fat along with mineral mixture supplemented animals were 3.39±0.03, 3.40±0.05 and 3.51±0.02 percent, respectively on 5th day of experiment. The level of milk fat constituent remains same in control and T1 group while the level of milk fat constituent significantly ($P<0.05$) increases in T2 group of animals supplemented with bypass fat along with mineral mixture and reached to a peak value of 4.20±0.04 percent on 25th day, which was maintained till the 60th day of experiment. The SNF constituent (Table 3) remain same in control, T1 group and T2 group of animals on different time periods throughout the experiment.

**Table 1. Content of mineral mixture used in experiment**

| Sr.No. | Ingredient | Content per Kg |
|---|---|---|
| 1. | Calcium | 24.6% |
| 2. | Phosphorus | 12.3% |
| 3. | Sulphur | 0.95% |
| 4. | Zinc | 9600 mg |
| 5. | Sodium | 25 mg |
| 6. | Potassium | 154 mg |
| 7. | Magnesium | 6000 mg |
| 8. | Manganese | 3000 mg |
| 9. | Iron | 2000 mg7 |
| 10. | Iodine | 500 mg |
| 11. | Copper | 4500 mg |
| 12. | Cobalt | 200 mg |
| 13. | Nicotinamide | 1000 mg |
| 14. | Vitamin E | 500 mg |
| 15. | Vitamin A | 7,50,000 IU |
| 16. | Vitamin $D_3$ | 75000 IU |

The overall result of bypass fat supplementation on milk yield, fat and SNF content is shown in Table 4. Overall average daily milk yield (L) of the lactating animals were significantly ($P<0.05$) greater in T2 group (11.83±0.13) than that of T1 group (11.28±0.06) and control group (10.39±0.13). Similarly milk yield of lactating animals of T1 group (11.28 ± 0.06) were significantly ($P<0.05$) higher than control group (10.39±0.13). Minerals might have vital role either in the form of cofactor or activator of enzymatic systems related with the metabolism of nutrient which resulted in significantly ($P<0.05$) rise in milk yield in comparison to control. Highest milk production of T2 group supplemented with bypass fat along with mineral

**Table 1. Milk Yield (L/day) at different Lactation days during experiment period (Mean ± SE)**

| Treatment group | Milk Yield ( L/day) at different Lactation days during experiment period | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 55 | 60 |
| Control | $10.75^{a}\pm$ 0.04 | $10.95^{b}\pm$ 0.05 | $11.06^{b}\pm$ 0.05 | $11.06^{b}\pm$ 0.04 | $10.50^{c}\pm$ 0.06 | $10.21^{d}\pm$ 0.09 | $10.16^{de}\pm$ 0.09 | $10.19^{d}\pm$ 0.10 | $10.15^{de}\pm$ 0.06 | $10.03^{e}\pm$ 0.07 | $9.85^{f}\pm$ 0.09 | $9.78^{f}\pm$ 0.08 |
| Treatment-1 | $10.80^{a}\pm$ 0.04 | $10.98^{b}\pm$ 0.04 | $11.06^{b}\pm$ 0.04 | $11.20^{c}\pm$ 0.04 | $11.35^{d}\pm$ 0.04 | $11.35^{d}\pm$ 0.04 | $11.41^{de}\pm$ 0.02 | $11.45^{de}\pm$ 0.05 | $11.46^{de}\pm$ 0.04 | $11.48^{e}\pm$ 0.04 | $11.42^{de}\pm$ 0.02 | $11.40^{de}\pm$ 0.08 |
| Treatment-2 | $10.81^{a}\pm$ 0.04 | $11.23^{b}\pm$ 0.04 | $11.53^{c}\pm$ 0.03 | $11.60^{c}\pm$ 0.03 | $11.76^{d}\pm$ 0.03 | $11.90^{e}\pm$ 0.03 | $12.05^{f}\pm$ 0.03 | $12.30^{g}\pm$ 0.04 | $12.20^{h}\pm$ 0.04 | $12.20^{h}\pm$ 0.05 | $12.22^{gh}\pm$ 0.05 | $12.20^{h}\pm$ 0.05 |

Mean with different superscript in row differ significantly *($p<0.05$)

**Table 2. Milk Fat constituent (Percent) at different Lactation days during experiment period (Mean±SE)**

| Treatment group | Milk Fat constituent (Percent) at different Lactation days during experiment period | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 55 | 60 |
| Control | 3.39± 0.03 | 3.39± 0.04 | 3.37± 0.04 | 3.38± 0.03 | 3.36± 0.03 | 3.35± 0.02 | 3.37± 0.02 | 3.38± 0.04 | 3.38± 0.04 | 3.37± 0.03 | 3.39± 0.04 | 3.38± 0.04 |
| Treatment-1 | 3.40± 0.05 | 3.45± 0.02 | 3.47± 0.01 | 3.47± 0.02 | 3.48± 0.01 | 3.48± 0.02 | 3.48± 0.01 | 3.48± 0.02 | 3.47± 0.02 | 3.45± 0.03 | 3.45± 0.03 | 3.46± 0.04 |
| Treatment-2 | $3.51^{a}\pm$ 0.02 | $3.90^{b}\pm$ 0.02 | $4.11^{c}\pm$ 0.03 | $4.15^{cd}\pm$ 0.03 | $4.20^{cd}\pm$ 0.04 | $4.19^{cd}\pm$ 0.03 | $4.18^{cd}\pm$ 0.05 | $4.20^{cd}\pm$ 0.04 | $4.20^{cd}\pm$ 0.05 | $4.19^{cd}\pm$ 0.05 | $4.21^{d}\pm$ 0.05 | $4.20^{cd}\pm$ 0.06 |

Mean with different superscript in row differ significantly *($p<0.05$) and Mean without superscript in row differ non-significantly *($p<0.05$)

**Table 3. Milk SNF constituent (Percent) at different Lactation days during experiment period (Mean±SE)**

| Treatment group | Milk SNF constituent (Percent) at different Lactation days during experiment period | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 55 | 60 |
| Control | 8.55± 0.05 | 8.56± 0.05 | 8.57± 0.04 | 8.54± 0.05 | 8.58± 0.04 | 8.58± 0.05 | 8.55± 0.04 | 8.53± 0.04 | 8.52± 0.04 | 8.54± 0.04 | 8.53± 0.05 | 8.54± 0.05 |
| Treatment-1 | 8.56± 0.04 | 8.57± 0.03 | 8.57± 0.03 | 8.57± 0.03 | 8.56± 0.03 | 8.55± 0.03 | 8.57± 0.03 | 8.56± 0.04 | 8.57± 0.04 | 8.55± 0.04 | 8.56± 0.04 | 8.55± 0.04 |
| Treatment-2 | 8.54± 0.05 | 8.57± 0.05 | 8.56± 0.04 | 8.59± 0.04 | 8.55 ± 0.05 | 8.55 ± 0.04 | 8.53 ± 0.05 | 8.57 ± 0.03 | 8.57 ± 0.04 | 8.58± 0.04 | 8.58± 0.04 | 8.56± 0.05 |

Mean without superscript in row differ non-significantly *($p<0.05$)

**Table 4. Overall milk yield, fat, and solid-not-fat constituent (Mean ± SE) of milk in lactating cattle during experiment period**

| Parameters | Control | Treatment-1 | Treatment-2 |
|---|---|---|---|
| Milk yield (Lit./day) | $10.39\pm0.13^{a}$ | $11.28\pm0.06^{b}$ | $11.83\pm0.13^{c}$ |
| Milk Fat | $3.376\pm0.003^{a}$ | $3.464\pm0.007^{a}$ | $4.104\pm0.06^{b}$ |
| SNF | $8.55\pm0.006^{NS}$ | $8.56\pm0.003^{NS}$ | $8.56\pm0.005^{NS}$ |

Mean with different superscript in row differ significantly *($p<0.05$); NS = Non-significant

mixture indicates that bypass fat fortified the milk yield enhancement by augmenting energy consistency of the ration, so that harmful effect of negative energy balance may be reduced (Mervat-Foda *et al*., 2009; Shelke and Thakur, 2011). Butt *et al.* (2020) found significantly higher overall mean milk yield in bypass fat supplemented crossbred cattle. Sirohi *et al.* (2010) showed profitable improvement in milk production of medium and/or high producing (10-20 kg/day) cross breed cows with the supplementation of bypass fat particularly in early lactation.

The milk fat percentage was significantly ($P<0.05$) improved by the feeding of bypass fat (Table 4). T2 group of animals supplemented with bypass fat along with mineral mixture showed significant ($P<0.05$) greater milk fat production percent (4.104± 0.06) as compare to animals of T1 (3.464±0.007) and control group (3.376±0.003). Mobeen *et al.* (2017) reported significant improvement in milk fat content in all the groups of Sahiwal cow given food to bypass fat. Rohila *et al.* (2016) in his study on Murrah buffaloes agreed with the significant rise in milk production, fat percent and total solid content of milk by

**Table 5. Economics of cost benefit ratio in different treatment groups**

| Parameters | Control | Treatment-1 | Treatment-2 |
|---|---|---|---|
| Total feed cost (Rs./anima/day) | 196.0 | 196.0 | 196.0 |
| Cost of mineral mixture (Rs./animal/day) | - | 3.50 | 3.50 |
| Cost of bypass fat (Rs./animal/day) | - | - | 16.00 |
| Total expenses (Rs./animal/day) | 196.0 | 199.5 | 215.50 |
| Average daily milk yield (Litter/animal) | 10.39 | 11.28 | 11.83 |
| Average fat composition (%) | 3.376 | 3.464 | 4.104 |
| 3.5% fat corrected milk yield (Litter/animal) | 10.20 | 11.24 | 13.02 |
| Cost of milk production (Rs./litter) | 19.21 | 17.75 | 17.31 |
| Sale of milk production (Rs./litter) | 26.40 | 26.40 | 26.40 |
| Income on sale of milk (Rs./animal/day) | 269.28 | 296.74 | 343.73 |
| Profit (Rs./day) | 73.28 | 97.24 | 128.23 |
| Cost benefit ratio | 1.37 | 1.49 | 1.59 |

feeding of bypass fat. A clear cut increase in milk fat percentage was reported by Kumar (2017) by supplementation of bypass fat in lactating dairy animals. Soni and Patel (2015) reported that100 g bypass fat per day per animal significantly improve the milk production and fat percentage. In protected feed supplemented group of cows fat content of milk was improved due to availability of more fatty acid to the mammary gland and thus to milk fat (Gulati *et al.*, 2003).

The SNF content among the treatment groups was differ non-significantly with the bypass fat Supplementation. Rohila *et al.* (2016) in his study on Murrah buffaloes reported non-significant influence on SNF content of milk by feeding of rumen protected fat.

**Economics of supplementation of bypass fat along with mineral mixture**

Economics of supplementation of bypass fat along with mineral mixture is given in Table 4. The feeding cost included price of concentrate, green fodder, dry fodder, mineral mixture and bypass fat. Expenditure on feed for milk production was evaluated to be Rs. 196.0 per cow per day in control group including the cost of dry fodder, green fodder and cost of all the ingredients used in homemade concentrate mixture. The feed cost of milk production was Rs. 199.5 per cow per day in T1 group included additional cost of mineral mixture given to the animals per day. The feed cost of milk production was Rs. 215.50 per cow per day in T2 group included additional cost of bypass fat and mineral mixture given to the animals per day. Average daily milk yield (L/animal), Average fat composition (%) and 3.5% fat corrected milk yield (L/animal) of each treatment group were calculated. Daily income was calculated as Rs. 269.28, Rs. 296.74 and Rs. 343.73 on each animal in control, T1 and T2 groups, respectively. The daily profit was evaluated as Rs. 73.28, Rs. 97.24 and Rs. 128.23 per animal in control, T1 and T2 groups, respectively. The cost-benefit ratio was calculated as 1:1.37, 1:1.49 and 1: 1.59 in control, T1 and T2 group of animals, respectively. It indicates that earning to the farmers had improved by bypass fat supplementation due to significant improvement in milk yield and fat production percentage. Parnerkar *et al.* (2010) and Rohila *et al.* (2019) were appraised that bypass fat supplementation improve income of dairy farmers with the rise in milk production and fat content. Prajapati and Patel (2019) also found increase in average daily income per buffalo with bypass fat supplementation in feed.

## CONCLUSION

The study indicates that bypass fat feeding along with mineral mixture significantly increase the average daily milk yield and fat percentage of the milk in lactating cattle. Improvement in milk yield and increased fat percentage of the milk of bypass fat supplemented lactating cattle was maintained at each time period of analysis during the experiment. It leads to beneficial effect to the farmers. The increase in 3.5% FCM yield improves the profit in rupees per day. It was found that bypass fat supplementation to the lactating cattle enhanced earning of the farmer with significant improvement in milk yield and fat production percentage.

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