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Effect of supplementation of dried yeast and fungi on yield and quality of milk in crossbred cows

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Abstract

In this study, 12 crossbred cows were divided into two equal Groups viz. Control (T₀) and Treatment (T₁) and observations were recorded for 91 days. The cows from group T₀ were fed with concentrate mixture as per BIS 1990 and roughage as per balanced ration requirements. Group T₁ received same diet as that of T₀ along with 15g dried yeast (*Saccharomyces cerevisiae* & *Kluyveromyces cerevisiae*) and fungi (*Aspergillus oryzae* and *Aspergillus niger*) per cow per day. The 4% FCM yield was significantly ($p < 0.05$) higher in treatment group over control group. The DM, DCP and TDN intake was significantly ($p < 0.01$) higher in treatment group as that of control group. The milk composition parameters viz. protein, fat, lactose, total solids and SNF were found statistically similar in treatment and control group. The CF and CP digestibility has improved in treatment group. The economics of milk production showed ₹ 12.65 increase in profit in the treatment group. From this study it is concluded that supplementation of 15 g of dried yeast and fungi /cow/day is cost effective and beneficial for enhancing cow performance.

Keywords: *Aspergillus niger*, *Aspergillus oryzae*, crossbred cow, *Kluyveromyces cerevisiae*, *Saccharomyces cerevisiae*

Introduction

Probiotics are live microorganisms which provide beneficial effect to host organism by restoring the gut microbiota. They have the ability to enhance intestinal health by stimulating the growth of beneficial bacteria, increasing digestive capacity, lowering the pH and improving mucosal immunity. It improves the microbiological balance of the host and thereby extract the nutrients to the maximum extent and get them deposited in end product. Probiotic metabolic components such as bacteriocins, amines and hydrogen peroxide interact with specific targets of multiple metabolic pathways to regulate apoptosis, cell proliferation, inflammation and differentiation (Plaza-Diaz *et al.*, 2019) [11].

The *Saccharomyces cerevisiae* culture provide various growth factors, pro-vitamins for bacterial growth in rumen to improve microbial activity which induces digestibility of dietary fibre, leading to enhanced feed intake. *Aspergillus oryzae* and *Aspergillus niger* of the *Trichocomaceae* family release amylolytic and fibrolytic enzymes and reduce the hydrolysis rate of the starchy and fibrous components of the ration and increase the production of ruminal microbial biomass and volatile fatty acids.

In present study, supplementation of dried yeast and fungi was assessed for its effect on milk yield and composition, somatic cell count, digestibility of nutrients, nutrient intake, feed efficiency and economics of milk production.

Materials and Methods

In this trial 12 crossbred (HF X Gir) cows were selected on the basis of breed, stage of lactation and daily milk yield. The selected cows were divided into two equal groups viz. control (T₀) and treatment (T₁) of six cows each. The control group received standard concentrate mixture (BIS 1990 Type-II) along with paragrass and Soyabean straw as per the regular feeding practices at farm. Treatment group received same concentrate mixture and roughages along with combination of dried yeast and fungi @ 15 g/cow/day.

During experimental period, the observations related to daily feed intake, daily milk yield and weekly milk composition were recorded for the animals from treatment and control group. The milk composition was recorded in terms of protein, fat, lactose, total solids and SNF at weekly interval. The efficiency of feed utilization was also calculated on weekly basis in terms of DM, TDN and DCP intake per kg 4% FCM yield. The somatic cell count of milk was recorded at fortnightly interval. The economics of milk production was calculated in terms of the cost of production. To determine the digestibility of organic nutrients, DM and OM, a digestion trial of seven days duration was conducted during the seventeenth week of the experiment by total collection method. The experiment was lasted for 13 weeks.

The proximate principles of feed and faeces was determined as per A.O.A.C. (2005) [1]. The calcium and phosphorus content was estimated as per Talapatra *et al.* (1940) [14] at the Animal Nutrition Department, Mumbai Veterinary College, Parel, Mumbai. Observations of various parameters recorded during the experimental period were tabularised and were statistically analyzed as per Snedecor and Cochran (1994) [12] by using two sample "t" test.

Results and Discussion

In this experiment, the effect of supplementation of dried yeast and fungi on milk yield and feed conversion efficiency in terms of DM, DCP, and TDN intake per kg FCM yield, milk composition (milk fat, total solids, protein, lactose and solids not fat), milk somatic cell count and economics of milk production were investigated. The results for the mentioned parameters are reported as below.

Milk yield

During 13-week experiment, the average milk output in the control (T_0) and treatment (T_1) groups was 7.94 ± 0.27 and 8.35 ± 0.19 kg, respectively. On statistical analysis, the result showed no significant difference between control and treatment group.

Fat corrected milk yield

The average 4% FCM yield was 8.30 ± 0.20 kg in the control group (T_0) and 8.85 ± 0.15 kg/day in the treatment group (T_1). On statistical analysis result showed that cows in the treatment group yielded significantly ($p < 0.05$) higher 4% FCM than cows in the control group. Result of present study are in accordance with Nocek *et al.* (2011) who had reported that supplementation of yeast culture (*Saccharomyces cerevisiae*) (56g/day) and enzymatically hydrolysed yeast (28g/day) showed increase in FCM by cows in treatment group. Contrary to the findings of present study Higginbotham *et al.* (1993) [7] reported that dietary supplementation of 3gm of *Aspergillous oryzae* extract in dairy cows showed no significant effect on 3.5% fat-corrected milk by cows in treatment group.

The increase in 4% fat corrected milk yield maybe associated with increase in dry matter intake associated with the effect of enzymes alpha-amylase and cellulase produced by *Aspergillous oryzae* and *Saccharomyces cerevisiae* providing stimulatory factor for rumen bacteria, such as vitamin B complex or branched chain VFA.

Dry matter intake

During 13-week period, the average daily dry matter intake of cows in the control (T_0) and treatment (T_1) groups was 10.54 ± 0.02 and 10.88 ± 0.06 kg, respectively. On statistical

analysis using the two sample T test, the results showed that the treatment group had significant ($p < 0.01$) increase in average daily dry matter consumption than cows in the control group. Result of present study are in accordance with Denigan *et al.* (1992) [5] who has reported that feeding 1.5 gm/day of *Aspergillus oryzae* fermentation extract showed significant increase in DM intake in dairy cows. On the contrary with the above finding Yuan *et al.* (2015) [15] who observed that cows fed with 30 and 60 g/d of *Saccharomyces cerevisiae* showed non-significant effect on dry matter intake in lactating cows.

The significantly higher dry matter intake in treatment group may be due to the characteristics of *Saccharomyces cerevisiae* to provide various growth factors, pro-vitamins and other stimulants for bacterial growth in rumen to improve the microbial activity which has induced better digestibility of dietary fibre, leading to enhanced feed intake.

TDN intake

During the experimental period, the average daily TDN intake of the control (T_0) and treatment groups (T_1) was 6.86 ± 0.01 and 7.41 ± 0.04 kg, respectively. The experimental data for average TDN intake was subjected to statistical analysis the average daily TDN intake by the cows from treatment group was significantly ($P < 0.01$) higher than control group. Result of present study are in accordance with the findings of Kim *et al.* (1992) [8] who reported that lactating Holstein cows fed on diet supplemented with 57 gm yeast culture plus 3 gm *Aspergillus oryzae* per day showed significantly higher TDN intake per day. Contrary to the findings of present study Takiya *et al.* (2017) [13] reported that feeding of 450 FAU/Kg *Aspergillous oryzae* extract showed non-significant effect on TDN intake in lactating dairy cows.

The higher TDN intake per day in treatment group may be due to effect of supplementation of yeast product which caused alternation in volatile fatty acid concentration, reduction in ruminal ammonia level, increased in ruminal microorganism population thereby and increase in nutrient digestibility.

DCP intake

During the experimental period, the average daily DCP consumption of cows in the control (T_0) and treatment (T_1) groups was 0.79 and 0.87 kg, respectively. The average daily DCP intake of cows in the treatment group was significantly ($p < 0.01$) higher than cows in the control group, on statistical analysis. Result of present study are in accordance with the findings of Ghoniem *et al.* (2018) [6] had also reported that feeding yeast at the rate of 10g/day showed significantly higher ($p < 0.05$) DCP intake in lactating dairy cows.

The increase in DCP intake is due to supplementation of dried yeast and fungi to dairy cows leads to low concentration of ammonia in the rumen which indicate greater utilization of protein for the microflora synthesis hence digestible crude protein get increases in rumen.

Feed efficiency

The efficiency of feed utilization by cows on different feed treatments was calculated in terms of DM, TDN, DCP required per kg of FCM showed non-significant effect.

Milk composition

During the experimental period, the average daily milk fat of cows in the control (T_0) and treatment (T_1) groups was 4.29 ± 0.21 and 4.37 ± 0.13 percent, the average milk protein

percentage of the control (T_0) and treatment groups (T_1) was 3.13 ± 0.09 and 3.20 ± 0.10 percent, the average SNF percentage in the control (T_0) and treatment (T_1) groups was 8.37 ± 0.19 and 8.66 ± 0.22 percent and the average milk total solids percentage of cows in the control (T_0) and treatment (T_1) groups was 12.66 ± 0.38 and 13.03 ± 0.33 percent.

During the 13-week investigation, the average milk lactose percentage of the control (T_0) and treatment groups (T_1) was 4.67 ± 0.13 and 4.70 ± 0.12 respectively. Average somatic cell count ($SCC \times 10^5/ml$ of milk) in milk from cows in the control (T_0) and treatment (T_1) groups was 6.53 ± 0.89 and 5.47 ± 0.78 , respectively. The result of the present study revealed that, supplementation of dried yeast and fungi had beneficial effect on the health of the udder and mammary

gland. Lower somatic cell count is attributed to dried yeast and fungi has beneficial impact in modulating immunological responses in the battle against udder mastitis. On statistical analysis result showed that cows in the treatment group yielded significantly lower milk fat, protein, SNF, Total solid, lactose and milk somatic cell count than cows in the control group.

Digestibility trial

During the last week of the study (85-91 days) the digestibility trial of seven days duration was conducted using the total collection method on six animals from each group, and digestibility coefficients for various nutrients were calculated.

Table 1: Average percent digestibility coefficients, TDN and DCP contents of both the experimental rations

| Nutrient | Groups | | |
|-----------------------|-------------------|---------------------|--------------|
| | Control (T_0) | Treatment (T_1) | Significance |
| Dry matter | 60.23 ± 0.43 | 62.49 ± 0.56 | ** |
| Organic matter | 62.54 ± 0.30 | 65.63 ± 0.38 | ** |
| Crude protein | 66.35 ± 0.32 | 71.18 ± 0.47 | ** |
| Ether extract | 74.45 ± 0.26 | 76.24 ± 0.37 | NS |
| Crude fibre | 61.13 ± 0.46 | 65.44 ± 0.48 | ** |
| Nitrogen free extract | 72.70 ± 0.29 | 74.61 ± 0.39 | NS |
| TDN % | 64.78 ± 0.30 | 67.98 ± 0.39 | ** |
| DCP% | 7.45 ± 0.03 | 8.06 ± 0.06 | ** |

**Significant at 1% level

NS - Non-significant

Economics of milk production

In animal production system, profit mainly depends on input-output relationship hence, the economics of milk production during the experiment was worked out by calculating daily returns per cow from both the experimental groups. The profit was calculated by considering mainly cost of concentrate mixture, roughages and supplements like dried yeast and fungi powder and the amount received on the sale of milk produced. The cost per kg concentrate mixture, soybean straw

and para grass was ₹ 35, ₹ 9.0 and ₹ 4.5 respectively. The dried yeast and fungi powder was ₹ 480/kg.

The daily income from milk sale for group (control) T_0 and (Treatment) T_1 was ₹ 143.3 and ₹ 155.95 which indicated that dried yeast and fungi powder supplemented group had profit of ₹ 12.65 per day over the control group. Thus, it is observed that, supplementation of dried yeast and fungi combination @ 15 g/cows/day was cost effective.

Table 2: Overall Performance of cows from both the experimental groups

| Parameters | Control | Treatment | Significance |
|--|------------------|------------------|--------------|
| Dry matter intake (kg) | 10.54 ± 0.02 | 10.88 ± 0.06 | ** |
| Milk yield (kg) | 7.94 ± 0.27 | 8.35 ± 0.19 | NS |
| 4% FCM yield (kg) | 8.30 ± 0.20 | 8.85 ± 0.15 | * |
| TDN % | 64.78 ± 0.30 | 67.98 ± 0.39 | ** |
| TDN intake (kg) | 6.86 ± 0.01 | 7.41 ± 0.04 | ** |
| DCP% | 7.45 ± 0.03 | 8.06 ± 0.06 | ** |
| DCP intake (kg) | 0.79 ± 0.00 | 0.87 ± 0.01 | ** |
| Feed efficiency | | | |
| DM intake (kg)/kg FCM yield | 1.28 ± 0.03 | 1.23 ± 0.02 | NS |
| TDN intake (kg) / kg FCM | 0.83 ± 0.02 | 0.84 ± 0.01 | NS |
| DCP intake (kg) / kg FCM | 0.10 ± 0.00 | 0.10 ± 0.00 | NS |
| Milk composition | | | |
| Fat (%) | 4.29 ± 0.21 | 4.37 ± 0.13 | NS |
| Protein (%) | 3.13 ± 0.09 | 3.20 ± 0.10 | NS |
| S.N.F. (%) | 8.37 ± 0.19 | 8.66 ± 0.22 | NS |
| Total solids (%) | 12.66 ± 0.38 | 13.03 ± 0.33 | NS |
| Lactose % | 4.67 ± 0.13 | 4.70 ± 0.12 | NS |
| SCC (somatic cell count) ($\times 10^5/ml$ of milk) | 6.53 ± 0.89 | 5.47 ± 0.78 | NS |

* Significant at 5% level

**Significant at 1% level

NS - Non-significant

Conclusion

The study revealed that, inclusion of dried yeast and fungi powder at the rate of 15g/cow/day is beneficial for improving production performance of crossbred cow in terms of milk production and its composition, nutrient intake, digestibility of nutrients and feed efficiency, as well as having a positive impact on mammary health by lowering somatic cell count and also it is cost effective.

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