SHORT COMMUNICATION

Evaluation of Yeast Culture Supplementation on Milk Yield and Rumen Fermentation in Dairy Cows - A Field Study in Chhattisgarh

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Abstract

Low milk yield remains a significant challenge for smallholder dairy farmers in Chhattisgarh, India, due to suboptimal nutrition and inefficient rumen fermentation. This study evaluated the effects of dietary supplementation with *Saccharomyces cerevisiae* yeast culture on milk production and rumen fermentation characteristics in lactating crossbred cows (30-60 DIM) under field conditions in Dhamtari and Raipur districts. A total of 40 cows were randomly allocated into two groups: Control (basal diet only) and Treatment (basal diet plus 10 g/day of yeast culture) over a 90-day period. Results showed a statistically significant improvement ($p<0.01$) in average daily milk yield in the yeast-supplemented group compared to the control (13.2±0.8 Vs. 11.1 ± 0.7 L/day), though the milk composition did not vary significantly. Additionally, rumen pH was better stabilized, total volatile fatty acids (TVFA) production was higher, and ammonia-N concentration was reduced in the treatment group, indicating improved rumen fermentation efficiency. These findings suggest that yeast culture supplementation is an effective and low-cost strategy for improving dairy productivity and rumen health in smallholder systems prevalent in tropical regions.

Key words: Dairy cows, Milk yield, Rumen fermentation, *Saccharomyces cerevisiae* Smallholder farmers, Yeast culture.

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Introduction

Dairy farming in Chhattisgarh plays a pivotal role in supporting rural livelihoods, with a majority of milk producers being smallholder or marginal farmers. However, low milk productivity remains a persistent challenge, largely due to nutritional imbalances, poor-quality roughages, and inadequate feeding strategies. Among the key nutritional constraints is suboptimal rumen fermentation, which compromises feed utilization efficiency and animal performance (Patel *et al.,* 2021). To address this, nutritional interventions such as probiotics and direct-fed microbials have gained prominence. Among these, *Saccharomyces cerevisiae* - a live yeast culture - has been extensively studied for its positive influence on rumen microbial ecology. It promotes the growth of cellulolytic bacteria, enhances fiber degradation, stabilizes rumen pH, and increases production of volatile fatty acids (Chaucheyras-Durand and Fonty, 2001; Ogunade *et al.,* 2019; Zhao *et al.,* 2021). These effects collectively translate to improved nutrient digestibility, higher milk yield, and better overall animal performance.

Recent meta-analyses and field studies confirm the efficacy of yeast supplementation across diverse production systems (Desnoyers *et al.,* 2009; Yuan *et al.,* 2022; Kalyesubula et *al.,* 2023). However, most of these studies have been conducted under controlled experimental conditions or in commercial dairy farms, with limited application in smallholder settings, particularly under tropical climates like that of Chhattisgarh. Field-based evaluations considering local feeding practices, climate, and farmer management are crucial to determine the practical utility of such interventions. This study was therefore undertaken to assess the impact of *S. cerevisiae* yeast culture supplementation on milk yield and rumen fermentation parameters in lactating crossbred dairy

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cows reared by smallholder farmers in Dhamtari and Raipur districts of Chhattisgarh.

Materials and Methods

The field trial was conducted between November 2023 and February 2024 in two representative dairy-intensive districts of Chhattisgarh: Dhamtari and Raipur. Both districts fall within the hot sub-humid agro-climatic zone and are characterized by winter temperatures ranging between 10-25°C, which are conducive for dairy production. Smallholder farmers in these areas typically rear crossbred cows (Jersey x Indigenous or HF x Indigenous), relying on mixed crop-livestock systems.

Animal Selection and Experimental Design

A total of 30 lactating crossbred cows, aged between 3-6 years, in their 2nd to 4th parity, and 30-60 days in milk (DIM), were randomly selected from 10 smallholder farms (5 per district). The animals had similar body condition scores (3.0-3.5 on a 5-point scale) and were housed under semi-intensive management. The cows were randomly assigned into two groups (n = 15 each):

Control Group: Fed a basal diet consisting of green fodder (maize/berseem), dry roughage (paddy straw), and concentrate mixture (16% CP, 70% TDN), provided as per NRC (2001) guidelines.

Treatment Group: Received the same basal diet plus 10 g/day of *Saccharomyces cerevisiae* yeast culture (commercial formulation, containing ≥10^8 CFU/g live cell-based product (Natural Remedies Pvt. Ltd. India) mixed into the morning concentrate ration for a continuous period of 90 days.

Feeding and Management Practices

All animals were maintained under uniform management practices. Clean drinking water was available *ad libitum*. Farmers were trained on proper mixing of the yeast culture and daily feeding records were maintained. No major disease outbreaks were reported during the trial.

Milk Yield and Composition

Milk Yield: Daily milk yield (morning and evening) was measured using calibrated spring balances for each cow and recorded throughout the 90-day period.

Milk Composition: Fortnightly composite milk samples (100 mL per cow) were collected and analyzed for fat (%), solids-not-fat (SNF), protein (%), and total solids using an automated milk analyzer (Lactoscan Milk Analyzer, Milkotester Ltd., Bulgaria), following the AOAC (2005) protocols. Density data were not recorded during the study and are therefore not reported.

Rumen Fermentation Parameters

On day 0, 45, and 90, rumen fluid samples were collected 3 h post-feeding via stomach tube aspiration and filtered through four layers of muslin cloth. The parameters analyzed in rumen liquor were: Rumen pH measured immediately using a portable digital pH meter, Ammonia nitrogen (NH^3-N) concentration estimated using the Conway micro-diffusion technique (Broderick and Kang, 1980), and Total volatile fatty acids (TVFA) estimated via the Markham distillation method as described by Barnett and Reid (1957).

Statistical Analysis

All data were analyzed using SPSS statistical software (version 26.0). The Shapiro-Wilk test was performed to ensure normal distribution. Results were expressed as mean ± standard deviation (SD). The effects of yeast supplementation over time were analyzed using repeated-measures ANOVA, and independent t-tests were used for group-wise comparison. A p-value of <0.05 was considered statistically significant.

Results and Discussion

Effect on Milk Yield

The treatment group supplemented with *Saccharomyces cerevisiae* showed a significant improvement in average daily milk yield compared to the control group. Over the 90-day feeding period, cows in the treatment group produced 13.2±0.8 L/day, while those in the control group averaged 11.1±0.7 L/day ($p<0.01$). This represents an approximate 19% increase in milk yield due to yeast supplementation. This finding aligned with previous studies indicating improved lactation performance with yeast culture supplementation. Ogunade *et al.* (2019) and Zhao *et al.* (2021) reported similar increases in milk yield (10-20%) across varying production systems. The observed increase is likely due to improved fiber digestion and enhanced ruminal microbial activity, leading to better nutrient utilization.

Effect on Milk Composition

While milk fat and protein percentages showed numerical increase in the treatment group, these differences were not statistically significant ($p>0.05$). Similarly, solids-not-fat (SNF) and total solids (TS) values also exhibited a slight numerical improvement in the treatment group; however, these changes were not statistically significant ($p>0.05$; Table 1). However, cows supplemented with yeast maintained better milk quality consistently throughout the trial, consistent with the findings of Desnoyers *et al.* (2009), though the effects may vary based on diet, breed, and stage of lactation.

Table 1: Effect of yeast culture on milk composition of lactating cows (Mean ± SE)

Parameter	Group		
	Control	Treatment	p-value
Milk fat (%)	4.0 ± 0.2	4.2 ± 0.3	0.12
Solid-not-fat (%)	8.2 ± 0.2	8.4 ± 0.3	0.15
Milk protein (%)	3.3 ± 0.1	3.5 ± 0.1	0.08
Total solids (%)	12.2 ± 0.3	12.6 ± 0.4	0.10

Rumen Fermentation Parameters

Rumen fermentation profiles showed significant improvement in cows receiving yeast supplementation. Rumen pH remained significantly higher in the treatment group (Table 2), indicating a more stable ruminal environment. This is attributed to the buffering action of yeast, which helps prevent subacute ruminal acidosis (SARA) during high-concentrate feeding (Chaucheyras-Durand *et al.,* 2008). Ammonia-N concentration was significantly reduced (Table 2), suggesting more efficient nitrogen utilization by rumen microbes, consistent with findings by Kumar *et al.* (2020). TVFA levels, a key indicator of fermentative efficiency, were significantly higher in the treatment group, indicating enhanced fermentation and energy availability for milk synthesis. These results confirm the positive influence of *S. cerevisiae* on rumen microbial balance, fiber degradation, and nutrient metabolism, especially in field conditions relevant to Chhattisgarh.

Table 2: Effect of yeast culture on rumen fermentation parameters of lactating cows (Mean ±SE)

Parameter	Group		
	Control	Treatment	p-value
Rumen pH	6.2 ± 0.1	6.6 ± 0.2	<0.01
Ammonia-N (mg/dL)	13.5 ± 1.1	10.2 ± 0.9	<0.01
TVFA (meq/L)	88.3 ± 3.4	102.7 ± 4.1	<0.01

Field-Level Implications

The study demonstrates that yeast supplementation is both practical and effective under smallholder dairy systems in Dhamtari and Raipur districts. Given the low cost and ease of mixing the supplement into daily rations, this strategy can be widely adopted by farmers to improve productivity without altering existing infrastructure. The findings also highlight the potential of nutritional interventions to address low productivity in tropical dairying systems. However, long-term studies across lactation cycles and different seasons on larger sample size are warranted to evaluate the real effects of yeast supplementation on productive, reproductive performance, animal health, and farm economics.

In general, the present field study conducted in Chhattisgarh demonstrated that dietary supplementation of *Saccharomyces cerevisiae* yeast culture significantly improved milk yield and rumen fermentation characteristics in lactating crossbred dairy cows managed by smallholder farmers. It resulted in a notable increase in daily milk yield (approximately 19%), improved rumen pH stability and higher total volatile fatty acid (TVFA) production, indicating enhanced fermentative efficiency, and reduced ruminal ammonia-N concentration, suggesting better nitrogen utilization. These findings affirm that yeast culture can serve as an effective, low-cost nutritional strategy to enhance productivity and digestive health in tropical dairy production systems.

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