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Popular Article

Native Yeast Probiotics: A Natural Feeding Strategy for Healthier Dairy Cattle

Vidhu Kumar*, Aryak Mishra, Shubhani Sharma, Sachin Kumar
Rumen Biotechnology Laboratory, ICAR–NDRI, Karnal–132001

*Email – www.kumarvidhu@gmail.com

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Abstract

The rumen of ruminant animals is a highly specialised fermentation chamber that supports a diverse microbial community essential for digestion and productivity. With increasing restrictions on antibiotic growth promoters due to antimicrobial resistance, attention has shifted toward probiotics as sustainable feed additives. Among these, yeast-based probiotics—particularly rumen-native yeasts—have emerged as promising alternatives. Indigenous yeast strains possess adaptive traits that allow them to survive ruminal stress conditions, stabilise fermentation, improve fibre digestion, and enhance animal performance. This article highlights the role of native rumen yeasts as probiotics in dairy cattle feeding, discusses their mechanisms of action, and summarises evidence supporting their application as next-generation, host-specific feed additives.

Keywords: Rumen microbiome, yeast probiotics, dairy cattle, native yeasts, fermentation, antimicrobial resistance

Introduction

Dairy cattle depend heavily on the rumen—a large anaerobic fermentation chamber—for converting fibrous plant materials into usable nutrients. This process is carried out by a complex community of microorganisms, including bacteria, archaea, protozoa, fungi, and yeasts, which together supply the host animal with energy in the form of volatile fatty acids and protein through microbial biomass (Clemmons et al., 2019; Keum et al., 2024). Over millions of years, this microbial ecosystem has co-evolved with ruminants, becoming highly resilient and adaptable to dietary changes (Khairunisa et al., 2023).

Traditionally, antibiotics were widely used in livestock feeding to promote growth and improve feed efficiency. However, the emergence of antimicrobial resistance (AMR) has raised serious global concerns, leading to strict regulations on antibiotic use in animal agriculture (World Bank, 2017; Kober et al., 2022). This has accelerated the search for natural



and sustainable alternatives that can maintain productivity without compromising public health.

Probiotics have gained prominence as one such alternative. Among probiotic candidates, yeasts have attracted considerable interest because of their ability to survive rumen conditions and positively influence fermentation. More recently, research has shifted focus from commercial yeast strains toward indigenous, rumen-derived yeasts that are naturally adapted to the ruminal environment and may offer superior benefits.

The Rumen: Nature's Fermentation Chamber

Microbial Complexity of the Rumen

The rumen functions as a large anaerobic bioreactor that houses an exceptionally diverse microbial ecosystem. This ecosystem includes bacteria, archaea, protozoa, fungi, viruses, and yeasts, each occupying specific ecological niches and performing specialised metabolic functions (Clemmons et al., 2019; Morgavi et al., 2013). Bacterial populations dominate numerically, followed by archaea, protozoa, and fungi, while the rumen virome remains poorly characterised (Newbold & Ramos-Morales, 2020).

Contribution of the Rumen Microbiome to Animal Productivity

Rumen microorganisms ferment complex carbohydrates into volatile fatty acids, which supply the majority of energy required for milk production and growth. Microbial cells themselves also serve as a major source of metabolizable protein for the host animal (Keum et al., 2024). This finely balanced system has evolved over millions of years, making it resilient yet sensitive to dietary and environmental disturbances (Khairunisa et al., 2023).

Declining Use of Antibiotics in Animal Feeding

Antibiotics and Growth Promotion

Since the 1950s, antibiotics have been incorporated into livestock diets at sub-therapeutic levels to enhance growth and feed efficiency. These compounds improved productivity by suppressing pathogenic microorganisms and optimising gut function (Kertz et al., 2017).

Antimicrobial Resistance: A Global Concern

The widespread use of antibiotics has contributed to the emergence of antimicrobial resistance, posing serious risks to both animal and human health. Global antimicrobial use in livestock continues to rise, particularly in developing countries (World Bank, 2017; Kober et al., 2022).

Regulatory Restrictions and the Search for Alternatives



In response, many countries have banned or restricted antibiotic growth promoters, creating an urgent need for effective and sustainable alternatives that can maintain animal performance without contributing to AMR (Veico-Siaz et al., 2019).

Why Yeast Probiotics Matter in Dairy Cattle Feeding

Probiotics are defined as live microorganisms that confer health benefits on the host when administered in adequate amounts (FAO/WHO, 2006). In ruminants, probiotics function primarily by modulating rumen microbial activity, improving nutrient utilisation, and stabilising fermentation patterns (Newbold et al., 1996; Chaucheyras-Durand et al., 2008). Yeasts differ from bacterial probiotics in several important ways. They are more resistant to environmental stress, tolerate fluctuations in pH and temperature, and can function effectively in the anaerobic rumen. Yeast supplementation has been associated with improved feed intake, enhanced fibre digestion, better rumen pH stability, and improved immune responses in dairy cattle (Mitchell et al., 2020; Wang et al., 2023).

While *Saccharomyces cerevisiae* dominates the commercial probiotic market, evidence suggests that it is not a natural resident of the rumen and may show inconsistent performance in vivo (Garcia-Mazcorro et al., 2020). In contrast, rumen-native yeasts such as *Pichia kudriavzevii*, *Candida rugosa*, and *Candida tropicalis* are well adapted to ruminal conditions and often demonstrate superior persistence and metabolic activity (Marrero et al., 2015; Suntara et al., 2021).

How Native Yeasts Improve Rumen Function

Native yeast probiotics exert their beneficial effects through multiple complementary mechanisms.

One of their primary roles is **oxygen scavenging**. Small amounts of oxygen enter the rumen during feeding and drinking, temporarily inhibiting strictly anaerobic, fibre-degrading bacteria. Yeasts rapidly consume this oxygen, restoring anaerobic conditions and supporting the growth of beneficial cellulolytic microbes (Newbold et al., 1996; Fonty et al., 2006).

Yeasts also stimulate microbial activity by releasing nutrients such as B-complex vitamins, amino acids, and peptides that promote bacterial growth and microbial protein synthesis (Chaucheyras-Durand et al., 2008). Some yeast species are capable of **lactate utilisation**, reducing lactic acid accumulation and helping to stabilise rumen pH, thereby lowering the risk of subacute ruminal acidosis (Plaizier et al., 2008; Song et al., 2025).

Additionally, yeast cell wall components such as β -glucans and mannoproteins enhance immune function and gut health, while competitive exclusion mechanisms limit pathogen colonisation (Silberberg et al., 2013; Wang et al., 2023).



Evidence from Rumen Yeast Research

Several studies have demonstrated the probiotic potential of rumen-derived yeasts. Indigenous strains of *Pichia kudriavzevii* and *Candida rugosa* have shown strong tolerance to acidic pH, volatile fatty acids, and elevated ruminal temperatures, all of which are critical for survival in the rumen (Fernandes et al., 2019; Wilachai et al., 2025).

In vitro studies indicate that *P. kudriavzevii* exhibits superior growth performance and efficient sugar utilisation due to its Crabtree-negative metabolism, allowing more energy to be channelled toward biomass production rather than ethanol formation (Pronk et al., 1996; Suntara et al., 2021). Yeast supplementation has also been shown to increase total volatile fatty acid production, enhance acetate levels, and improve fibre degradation efficiency (Wang et al., 2022; Song et al., 2025).

Importantly, recent research has revealed considerable yeast diversity in the goat rumen, with dominant species including *Candida rugosa*, *Pichia kudriavzevii*, and *Trichosporon asahii* (Song et al., 2025). These findings highlight the untapped potential of host-specific yeasts for ruminant feeding applications.

Mechanisms of Action of Native Yeast Probiotics

Oxygen Scavenging and Redox Regulation

Yeasts rapidly consume residual oxygen entering the rumen during feed intake, restoring anaerobic conditions and supporting fibre-degrading bacteria (Newbold et al., 1996; Fonty et al., 2006).

Stimulation of Beneficial Microbial Populations

Native yeasts release essential nutrients such as vitamins, amino acids, and peptides that promote bacterial growth and enhance microbial protein synthesis (Chaucheyras-Durand et al., 2008).

Regulation of Lactic Acid and Rumen pH

Certain yeast species assimilate lactic acid, preventing its accumulation and helping to stabilise rumen pH during high-concentrate feeding (Plaizier et al., 2008; Song et al., 2025).

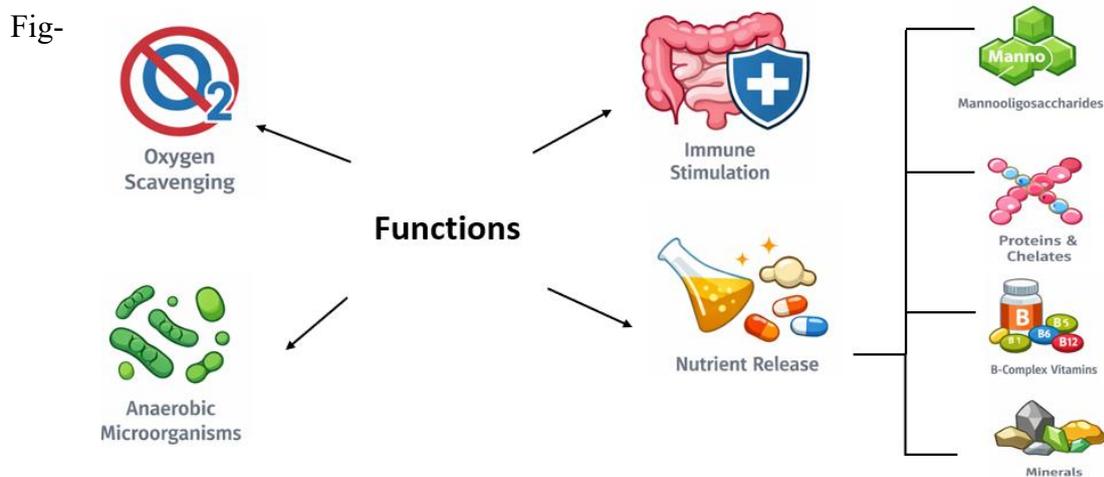
Enhancement of Fibre Degradation

Yeasts improve fibre digestion by stimulating cellulolytic bacteria and, in some cases, producing fibrolytic enzymes, leading to improved dry matter digestibility (Suntara et al., 2021).

Immune Modulation and Pathogen Control



Yeast cell wall components such as β -glucans and mannoproteins enhance immune responses and competitively exclude pathogenic microorganisms (Silberberg et al., 2013; Wang et al., 2023).



Mechanism of Action of Native Rumen Yeast

Practical Implications for Dairy Farmers

The incorporation of native yeast probiotics into dairy cattle diets offers several practical benefits, including improved feed efficiency, enhanced rumen stability, and reduced dependence on antibiotics. These advantages are particularly relevant under intensive feeding systems where rumen stress and acidosis are common challenges.

Future Prospects of Yeast Probiotics in Dairy Nutrition

Advances in molecular identification and in vitro screening techniques have opened new opportunities for the development of customised, host-specific yeast probiotics. Future research should focus on strain selection, formulation stability, and large-scale field validation to maximise their benefits in dairy production systems.

Conclusion

The growing challenge of antimicrobial resistance has created an urgent need for natural and sustainable feed additives in dairy production systems. Native rumen yeasts represent a promising solution due to their inherent adaptation to ruminal conditions and their multifaceted probiotic functions. By stabilising rumen pH, enhancing fibre digestion, supporting beneficial microbial populations, and improving fermentation efficiency, indigenous yeast probiotics can contribute to healthier animals and improved productivity. Future research and development should focus on isolating, characterising, and formulating host-specific yeast strains to maximise their effectiveness as next-generation probiotics.



Incorporating native yeasts into dairy cattle feeding strategies offers a practical and eco-friendly approach to improving rumen health while reducing reliance on antibiotics.

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