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Effects of using feed additives on rumen fermentation parameters and microbial populations in pre- and post-weaning calves

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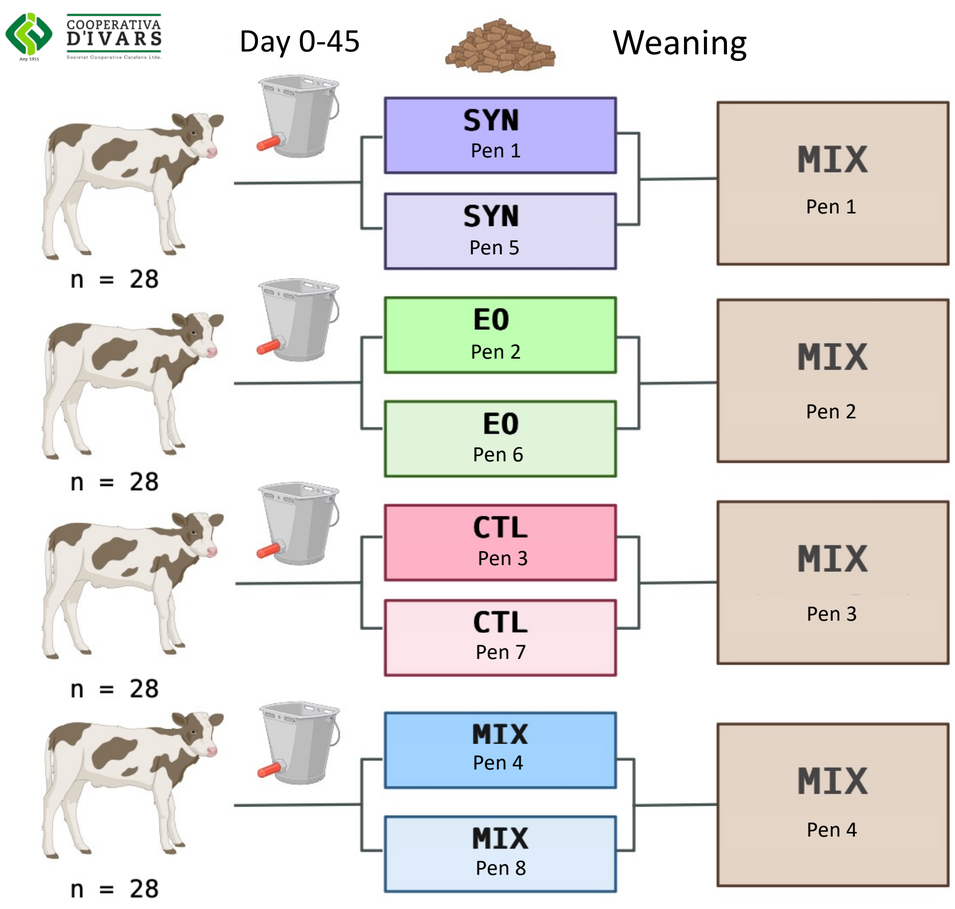
Introduction

- In the intensive breeding system for beef calves, calves are **separated from their mothers** after birth. This practice affects the **microbial colonization** of the rumen, which is crucial in the early stages of life for optimal development of the animal.
- Suckling calves are **susceptible to disease** due to an immature immune system and an underdeveloped digestive tract.
- In recent years, farm management has been improved, with particular emphasis on providing **proper colostrum** and developing **nutritional strategies** that support the growth, maturation of the intestinal tract, and long-term health [1-3].
- The **objective** of the study is to evaluate the impact of different nutritional treatments with additives on ruminal fermentation and microbial quantification in suckling Montbéliarde calves.

Materials and methods

- **112 suckling calves** were classified into **4 diet groups**: CTL (no additives), EO (essential oils from plants), SYN (yeast probiotics) and MIX (mixture of probiotics and essential oils).
- Calves received their respective diet with additives in the concentrate feed **for 45 days (until weaning).** After weaning, all calves **were switched to the MIX diet.**
- Rumen content and blood samples were collected at **days 35 (pre-weaning) and 105 (post-weaning).**



Results

- There was an increase in the **concentration of total volatile fatty acids (tVFAs) in the rumen** of the animals that received the diets with additives, compared to the CTL. Significant differences were observed two months after weaning (post-weaning) (Table 1).
- **Blood concentrations of ß-Hydroxybutyrate** of animals taking additives tended to increase significantly compared to CTL (Table 1).
- There were variations among additive groups in rumen protozoa populations, whereas bacteria, archaea, and fungi tended to increase and homogeneously standardize as the animals grew and developed their rumen (Figures 1 and 2).

Table 1. Ruminal fermentation parameters in suckling calves fed commercial additives.

Pre-weaning	Mean CTL	Mean MIX	Mean EO	Mean SYN	SE	*P-value*
Total Volatile Fatty Acids (mM)	92.2	105.5	101.6	90.4	2.587	0.126
Beta-Hidroxybutyrate (mg/dL)	2.22^{c}	2.90^{ab}	3.19^{a}	2.58^{bc}	0.093	0.001**
Post-weaning	**MIX**	**MIX**	**MIX**	**MIX**	**SE**	***P-value***
Total Volatile Fatty Acids (mM)	73.1^{d}	92.1^{bc}	104.1^{abc}	97.8^{c}	2.418	0.001**
Beta-Hidroxybutyrate (mg/dL)	3.01^{b}	4.56^{ab}	3.98^{ab}	5.72^{a}	0.265	0.006**

Figure 1. Microbial community distribution in **pre-weaned** calves.

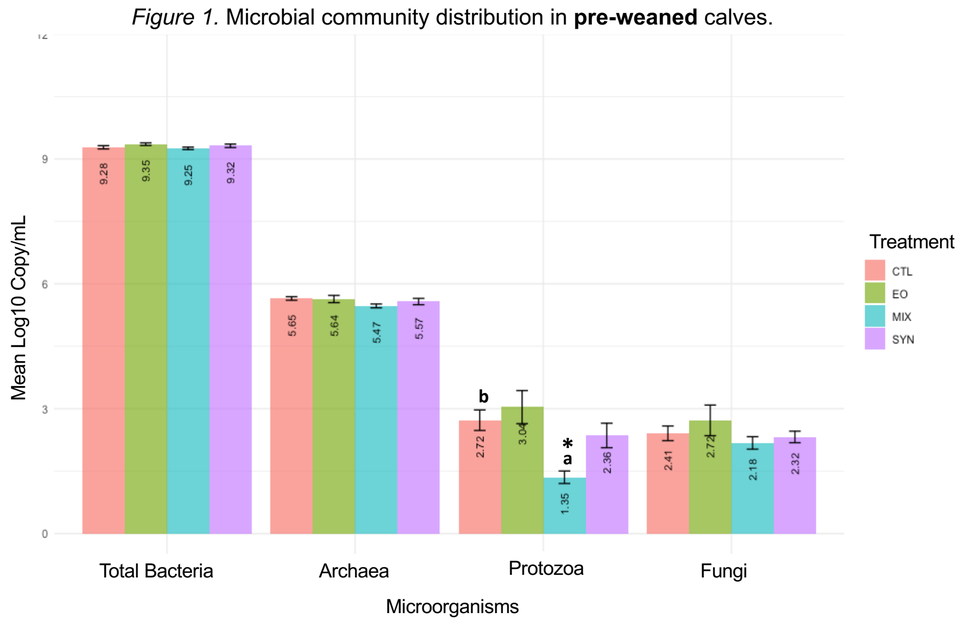
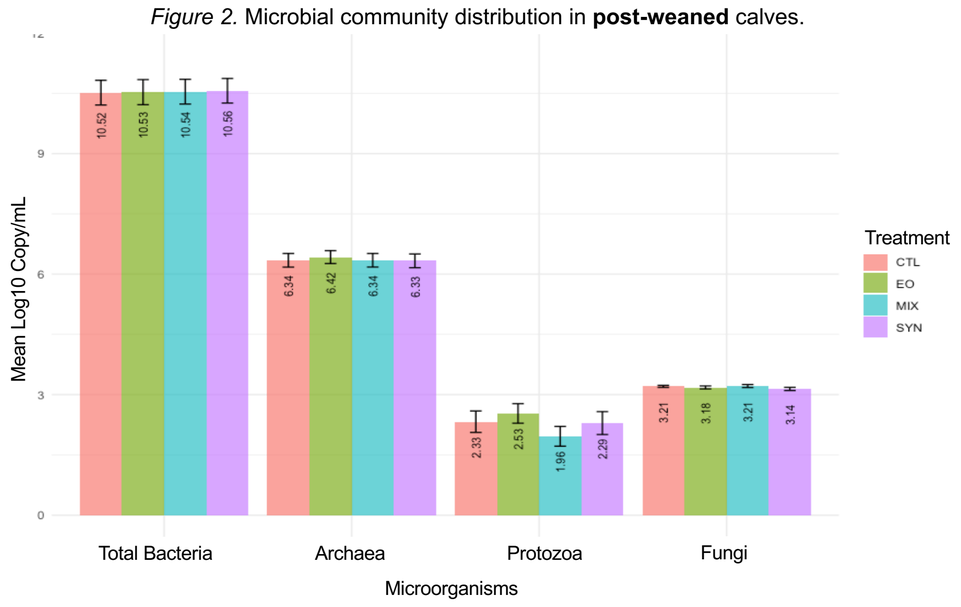


Figure 2. Microbial community distribution in **post-weaned** calves.



Conclusions

- The treatment with additives during lactation resulted in **higher ruminal fermentation**, an effect that was maintained two months later. This highlight the importance of applying such treatments **at the beginning of the animal's development** when the rumen has a greater plasticity.
- Microbial group quantification did not show significant differences. However, it is necessary to investigate whether there were changes in the composition and activity of the microbiota.

Bibliography

[1] Devant, M. & Marti, S. Animals vol. 10, 1–20 (2020).
[2] Snelling, T. J. et al. Anim Microbiome 1, 16 (2019).
[3] Yu, S. et al. Anim Feed Sci Technol 264, 114465 (2020).

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