III Jornadas de la Juventud Investigadora

Granada, October 2024

Effects of long transportation of male dairy beef calves and feed additives on physiological status and rumen microbial fermentation pre- and postweaning

E. Romera-Recio[1], E. Ramos-Morales[1], A. Belanche[2], M. Hassan[1], P. Romero[1,4], A. Gomez-Mesonero[1], N. LLanes[3], J. Torra[3], D.R. Yañez-Ruiz[1]*

[1] Zaidin Experimental Station (EEZ), CSIC, Profesor Albareda 1, 18008, Granada.
[2] Department of Animal Production and Sciences of the Food, Zaragoza University, Miguel Servet 177, 50013, Zaragoza.
[3] Cooperativa d'Ivars, Carrer de Lleida, 2-8, 25260 Ivars d'Urgell, Lleida.
[4]Department of Animal Science, University of California, Davis, CA 95616, USA.
*david.yanez@eez.csic.es

Introduction

- In intensive beef calf breeding, **early separation from mothers** impacts rumen microbial colonization, essential for calf development.
- In Spain, 3-week-old calves face health challenges during **long-distance transport** to fattening farms, exacerbated by their immature immune systems and underdeveloped digestive tracts.
- Recent farm management improvements focus on **proper colostrum and nutritional strategies** to promote intestinal development and long-term health [1-3].

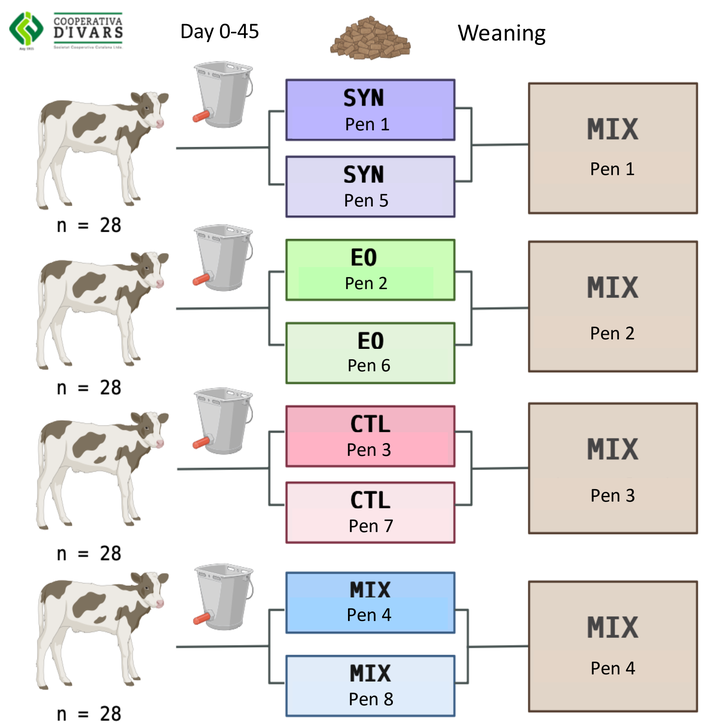
Materials and methods

Experiment 1:

- **66 male suckling calves**, aged 21 ± 7 days, were randomly selected at the assembly farm center in Saint-Sulpice-des-Rivoires, France.
- The calves were transported **750 km over a 12-hour journey** to Cooperative d'Ivars in Ivars d'Urgell, Lleida, Spain.
- **Blood samples** were collected **before and after transportation** to assess health status and stress response.

Experiment 2:

- **112 male 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).**



Acknowledgments and funding

This project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under grant agreement N° 101000213 (**HoloRuminant**).

Bibliography

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Results

Experiment 1:

Table 1. Blood parameters in suckling calves before and after transportation.

	Mean		SE	*P-value*
	Before	**After**		
IgG (mg/dL)	1.48	4.88	0.25	<0.001
Cortisol (mg/dL)	1.00	1.06	0.03	0.066
Glucose (mg/dl)	37.9	15.6	4.57	0.006
Insulin (mg/dl)	4.12	2.84	0.79	0.111
Urea (mg/dl)	35.6	31.0	1.69	0.009
Creatinine (mg/dl)	1.28	1.25	0.07	0.639
Non-Esterified Fatty Acids (NEFA)	0.20	0.18	0.03	0.477
Beta-Hidroxybutyrate (mg/dL)	0.68	0.84	0.11	0.162

Experiment 2:

Table 2. Ruminal fermentation parameters and microbial population (qPCR) in suckling calves fed commercial additives.

	Mean					
Pre-weaning	**CTL**	**MIX**	**EO**	**SYN**	**SEM**	***P-value***
Total VFAs (mM)	92.9	104	101	90.8	5.38	0.222
Beta-Hidroxybutyrate (mg/dL)	2.33^{c}	2.88^{ab}	3.20^{a}	2.51^{bc}	0.18	0.004
pH	6.13	5.94	6.19	6.49	0.17	0.169
Microbial population						
Total Bacteria	9.27	9.26	0.35	9.32	0.04	0.273
Archaea	5.65	5.47	5.63	5.60	0.07	0.360
Protozoa	nd	nd	nd	nd		
Fungi	nd	nd	nd	nd		
Post-weaning	**MIX**	**MIX**	**MIX**	**MIX**	**SEM**	***P-value***
Total VFAs (mM)	76.0^{b}	93.8^{a}	102^{a}	94.4^{a}	4.72	0.002
Beta-Hidroxybutyrate (mg/dL)	3.07^{b}	4.56^{ab}	3.93^{b}	4.68^{a}	0.23	<0.001
pH	6.83^{a}	6.42^{b}	6.61^{ab}	6.41^{b}	0.11	0.019
Microbial population						
Total Bacteria	10.5	10.6	10.5	10.6	0.31	0.997
Archaea	6.33	6.39	6.43	6.34	0.17	0.973
Protozoa	nd	nd	nd	nd		
Fungi	3.20	3.22	3.19	3.14	0.04	0.387

Conclusions

- Transportation of dairy beef calves caused **mild stress**, indicated by increased IgG and cortisol levels, but **did not significantly impact fat mobilization or hydration** due to pre-transport milk replacer feeding.
- Dietary additives increased total volatile fatty acids (tVFAs) and ß-Hydroxybutyrate levels post-weaning, **enhancing ruminal fermentation**.
- Rumen pH increased after weaning, populations of bacteria and archaea increased post-weaning, with protozoa and anaerobic fungi remaining mostly absent.
- **The effect of the additives 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.