Effect of two alternative feed supplements on ruminal physicochemical parameters in dairy cows

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Background and Objective

Considerable knowledge has been gained in recent years on the potential use of feed additives which might help to reduce ruminal acidosis and methane production in ruminants. Many alternatives have been evaluated to control specific microbial population to modulate rumen fermentation, including the use of yeasts, organic acids and plant extracts. Based on the mechanisms of action of these different additives, it is possible to identify potential synergies. So, the objective of this study was to test two ruminant supplements: one based on malate plus inactivated yeast, and the second based on plant extract plus inactivated yeast.

Materials and Methods

- Three Holstein dry dairy cows, fitted with ruminal cannulas, were allocated in a 3 × 3 Latin square design, and fed with a total maize-silage-based-mixed ration as control (C) diet supplemented with 100 g/d of a mixture of inactivated yeast and malate (MY) or plant extract (PEY) during a 28-d experimental period (10 d of diet adaptation, 3 consecutive days for measurement and sampling, and 15 d of transition).
- Ruminal pH and redox potential (E_h) were recorded hourly over a 9-h period from 1 h before to 8 h after the morning meal, using the *ex vivo* method of Marden et *al.* (2005). Clark's Exponent (rH) was calculated by integrating both pH and E_h values in the Nernst's equation: rH = E_h (mV)/30 + 2 pH. Ruminal fluid was sampled at 0, 2, 4, 6, and 8h after the morning meal for VFA, NH_3-N, and lactic acid determinations.
- Data were analyzed using a repeated-measures model (SPSS) including the effects of cow, treatment, period and hour.

Results and Discussion

- Mean pH tended (P = 0.077) to be greater with MY and PEY than C: both supplements induced a ruminal pH stabilization after feeding, but MY resulted in maintening pH above the threshold value of 6 over 8 hours after feeding.
- Ruminal E_h drastically shifted to more negative values and rH was decreased with PEY and MY compared with C, indicating that both supplements strengthened the reducing power of the milieu.
- Total VFA content remained constant between treatments. Acetate concentration tended (P = 0.08) to be greater with MY and PEY than with C (54 vs 49 mM).
- Others VFA, lactic acid and ammonia concentrations did not differ among treatments.

Table 1. Effect of alternative feed supplements on ruminal physicochemical and fermentative parameters

	Treatment[1]				Significance[2]	
	C	MY	PEY	SEM	T	P
Physicochemical parameters						
pH	6.20	6.36	6.31	0.02	*	NS
E_h, mV	-158*b*	-188*a*	-192*a*	2.02	**	NS
rH[3]	7.12*a*	6.43*b*	6.20*b*	0.05	**	NS
Fermentative parameters						
Total VFA, m*M*	78.5	84.1	87.0	1.40	NS	NS
C2, m*M*	49.3	54.3	54.7	0.83	*	NS
C3, m*M*	12.8	13.9	14.9	0.40	NS	*
C4, m*M*	12.9	12.1	13.3	0.30	NS	NS
IC4, m*M*	0.79	0.92	0.85	0.01	*	*
C5, m*M*	0.88*b*	1.06*a*	1.08*a*	0.03	**	*
IC5, m*M*	1.77*b*	1.71*b*	2.04*a*	0.03	**	NS
Lactate, m*M*	1.25	1.49	1.81	0.16	NS	NS
NH_3-N, mg/L	70.8	71.9	70.3	4.77	NS	NS

[1] C = control; MY = malate + inactivated yeast; PEY = plant extract + inactivated yeast.
[2] ** *P* < 0.05; * *P* < 0.10; NS = non significant; T = treatment effect; P = period effect.
[3] rH = E_h (mV) / 30 + 2pH (Marounek et *al*., 1987).

Figure 1. Effect of alternative feed supplements on the evolution of ruminal pH

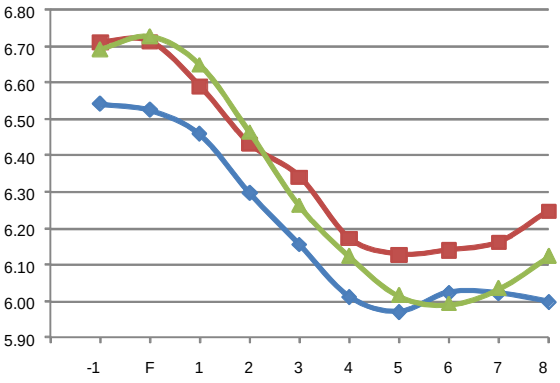
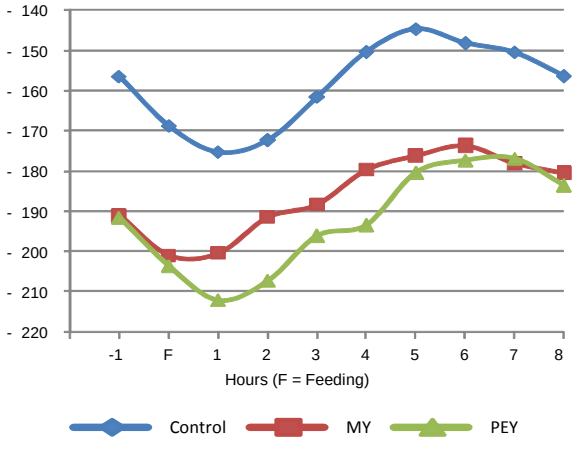


Figure 2. Effect of alternative feed supplements on the evolution of ruminal redox potential (mV)



In conclusion, **the stabilization/increase of ruminal pH with both MY and PEY was not associated with a lower lactic acid concentration. Both supplements had a pH stabilization effect, probably via their intrinsic capacity to neutralize protons and to strengthened the reducing power of the milieu. These better conditions of ruminal environment could favour the activity of cellulolytic bacteria.**

Marden et *al*., 2005. *J. Dairy Sci*. 89:2668-2678. Marounek et *al*., 2006. *Physiol. Bohemoslov*. 36:71-74.