



In vivo and In Vitro Measurements of Ruminant Redox Potential: a Comparative Study

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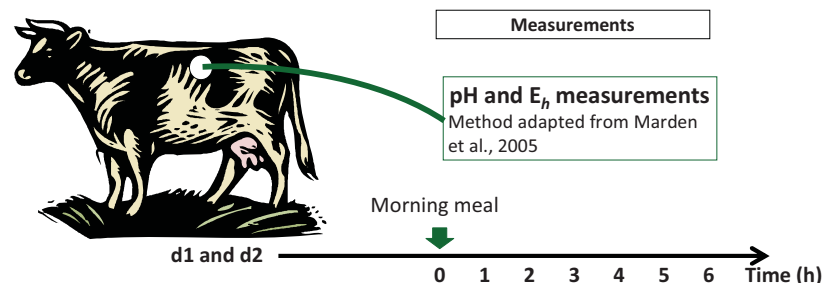
Background and Objective

Batch ruminal cultures are often considered as an interesting tool to study rumen metabolism. It is therefore necessary to verify if ruminal conditions offered by means of *in vitro* approach are similar to *in vivo* in terms of oxydo-reduction level assessed by the measurement of redox potential (E_h).

Methods

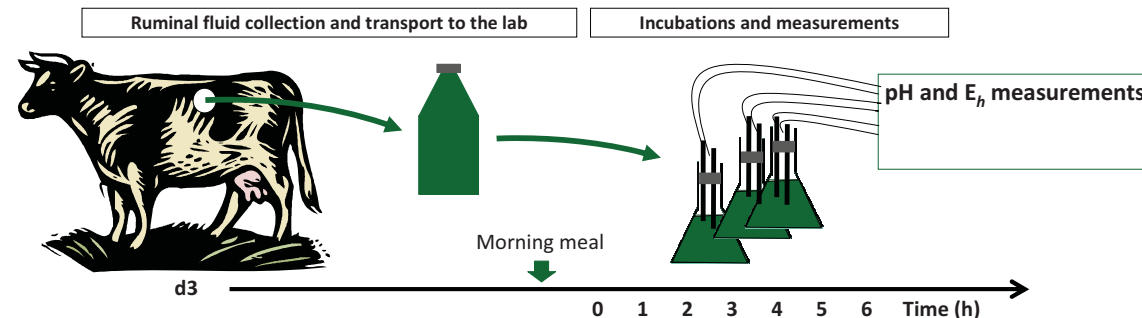
IN VIVO

A method adapted from Marden et al. (2005) allowed continuous ruminal fluid sampling and physico-chemical parameters measurements in anaerobic conditions.



IN VITRO

Ruminal fluid was sucked out the rumen just before morning meal, transferred to the laboratory under anaerobic conditions at 39°C and divided in 10 flasks (125 mL/flask). In each flask, substrates (starch, hay and urea) and a buffer solution (pH = 7, 125 mL/flask) were added. Flasks were bubbled with CO₂ and kept from light and air at 39°C in a waterbath rotary shaker. Two control flasks, not incubated and without any substrates were immediately frozen. Each incubated flask was equipped with a combined pH and a platinum electrode and closed to maintain anaerobiosis and enabling gas evacuation.



Results and Discussion

Fermentative parameters:

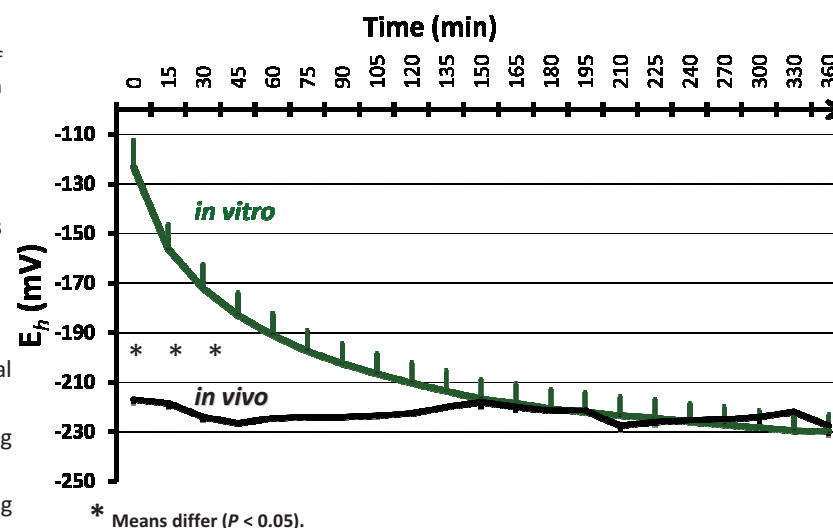
- At 0h, some differences between *in vitro* and *in vivo* values because of ruminal fluid aeration, transfer to the lab and dilution with buffer solution for *in vitro* incubations.
- At 6h, no more difference

Physico-chemical measurements:

- At 6h, different pH because of buffer solution used *in vitro*
- At 0h, *in vivo* E_h (− 217 mV) differed ($P = 0.003$) from *in vitro* value (− 123 mV) probably because of ruminal fluid contact with air outside the rumen.
- After 2 h, both methods yielded similar E_h values

Conclusions

- After the first 2 hours of incubation, the batch *in vitro* experimental method offered reducing conditions close to the rumen.
- After 6 hours of incubation, it offered a fermentative and reducing environment close to the rumen.
- Ruminal microbiota activity restored rapidly the strong reducing conditions *in vitro* after an exogenous perturbation.



* Means differ ($P < 0.05$).

Reference: Marden, J. P., C. Bayourthe, F. Enjalbert, and R. Moncoulon. 2005. A new device for measuring kinetics of ruminal pH and redox potential in dairy cow. J. Dairy Sci. 88:277-281.

		<i>in vitro</i>	<i>in vivo</i>	SEM	P-value
Total VFA (mM)	0h	36.9	60.1	1.76	0.01
	6h	67.3	74.8	4.04	0.12
Acetate (mM)	0h	26.5	43.0	1.43	0.02
	6h	46.0	52.2	2.75	0.07
Propionate (mM)	0h	4.65	7.79	0.11	<0.01
	6h	10.3	10.5	0.72	0.81
Butyrate (mM)	0h	4.17	6.66	0.18	0.01
	6h	8.88	9.44	0.50	0.33
D + L Lactate (mM)	0h	0.62	0.03	0.01	0.01
	6h	0.07	0.05	0.04	0.68
pH	0h	6.98	6.83	0.07	0.08
	6h	6.80	6.61	0.06	0.01