

Effect of lactic acid treated by-product concentrate, in a diet w/out inorganic P supplementation on ruminal fermentation and nutrient degradation in vitro

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Introduction

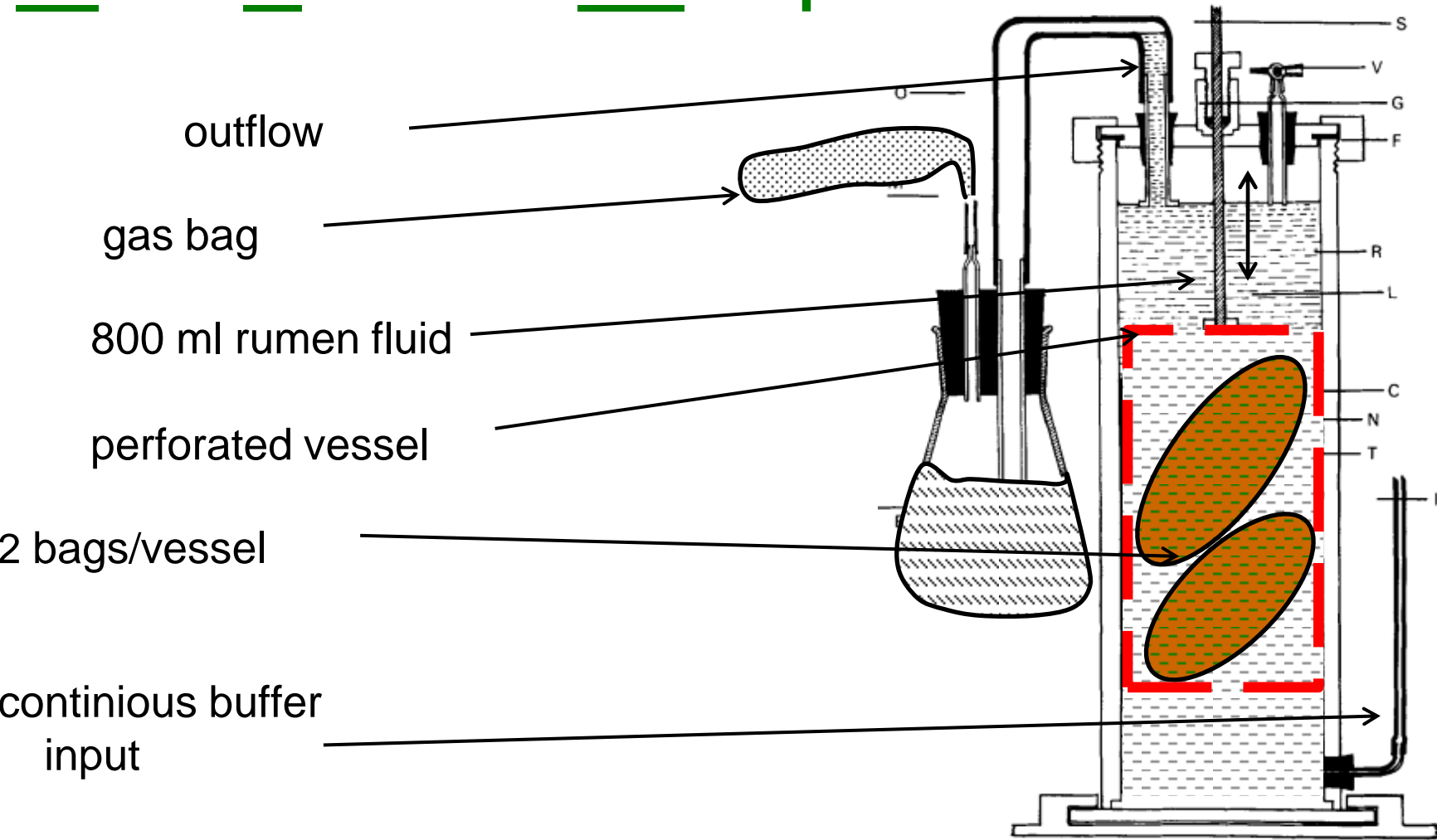
- **linear degradation** of phytic acid with increased concentration of **lactic acid** (Metzler-Zebeli et al. 2014)
- Harder et al. 2015 (RUSITEC trial):
 - **enhanced SCFA** (short chain fatty acids) **production** from lactic acid (LAc) treated barley **when no inorganic P** was supplemented
 - **decrease of NH₃ conc.** in rumen fluid **through lactic acid treatment** regardless of P level

Research question

- What are the effects of **lactic acid treatment** of a **by-product mixture** and the supplementation of **inorganic P** on ruminal fermentation and nutrient degradation in vitro (**RUSITEC**)?

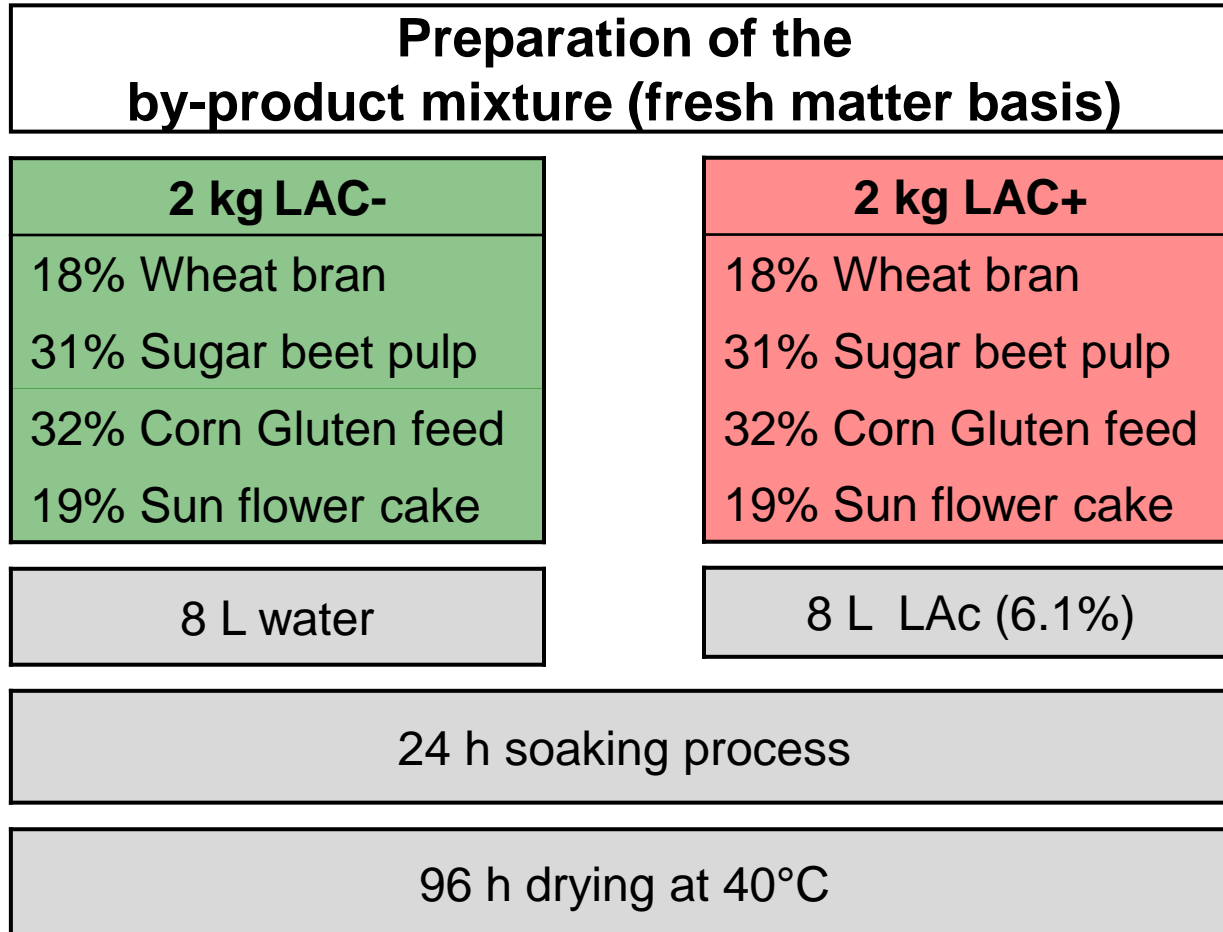
RUSITEC (I) - How does it work?

Rumen Simulation Technique



(Czerkawski & Breckenridge 1977)

Experimental design (I)



Experimental design (II)

Diet formulation (10 g/bag) – dry matter basis

P-
(inorganic P-free)

P+
(inorganic P supplemented)

LAC-

LAC+

LAC-

LAC+

5.0 g Forages
4.8 g by-product mixture
0.2 g Minerals, P-free

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Diet – Nutrient content

Item (g/kg DM)	P -		P +	
	LAC -	LAC +	LAC -	LAC +
OM	899	904	899	904
CP	171	153	171	153
aNDFom	538	510	538	510
ADFom	268	255	268	255
NFC ¹	160	211	160	211
total P	5.2	4.8	7.1	6.7

¹ NFC = 1000 - CA - CP - EE - aNDFom

+ 1.9 g/kg DM inorganic P supplementation

RUSITEC - setup

	Unit I						Unit II					
Vessel	1	2	3	4	5	6	7	8	9	10	11	12
Run 1	P-	P-	P-	P-	P-	P-	P+	P+	P+	P+	P+	P+
	LAC	LAC	LAC	LAC	LAC	LAC	LAC	LAC	LAC	LAC	LAC	LAC
	+	-	+	-	+	-	-	+	-	+	-	+
Run 2	P+	P+	P+	P+	P+	P+	P-	P-	P-	P-	P-	P-
	LAC	LAC	LAC	LAC	LAC	LAC	LAC	LAC	LAC	LAC	LAC	LAC
	-	+	-	+	-	+	+	-	+	-	+	-

Statistical Analysis – SAS 9.4

- Proc. mixed (REML)
- Statistical model:
 - $Y = T_1 + T_2 + T_1 * T_2 + Run + Fermenter + \varepsilon$

T_1 ... LAC-/LAC+

T_2 ... P-/P+

Results

- SCFA
- Nutrient degradation

SCFA concentration in rumen fluid

Item	P -		P +		P- Value		LACxP
	LAC -	LAC +	LAC -	LAC +	LAC	P	
SCFA (mmol/l)	99.7	110.7	94.7	103.7	<0.05	<0.05	0.43

- Total **SCFA concentration** was highest in LAC+ diets when no inorganic P was added
- LAC **supplies energy** for microbiota

Nutrient degradation

- CHO degradation was only affected by P addition
 - degradation of fiber was higher in P- diets
 - degradation of non fiber carbohydrates was higher in P+ diets
- CP degradation was affected by P and LAc addition
 - NH_3 conc. corresponded with magnitude of CP degradation

Discussion

- Lower SCFA concentration was lower compared to previous studies although **application rate of LAC** was higher
- LAC+ caused **dilution of nutrients**
- **inorganic P** enhanced NFC degradation at the expense of other nutrients
- LAC might **degraded phytate** (Metzler-Zebeli et al. 2014) and might enhanced **utilisation of dietary P sources**

Conclusions

- P supplementation
 - organic P, released by LAC+, might be a better source of P for ruminal microbiota than inorganic P

- Lactic acid treatment
 - substantially contributed to the supply of available energy