Monitoring the rumen microbial populations changes during feed-induced lactic, butyric or propionic acidosis in sheep

Abderzak Lettat, Pierre Noziere, Mathieu Silberberg, Diego Morgavi, Cécile Martin

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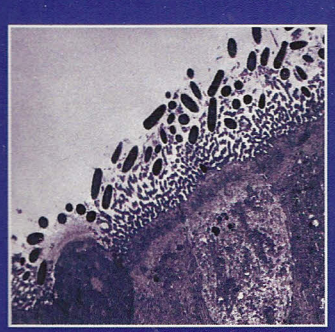

Gut Microbiology:

new insights into gut microbial ecosystems

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Effect of selected antibiotics on growth and metabolism of *Megasphaera elsdenii* NCIMB 41125, a lactate utilising probiotic for ruminants.

Pieter Henning[1], Anu Kettunen[2], Juha Apajalahti[2], Frans Hagg[1], Charles Horn[1]
[1]MS Biotech, Centurion, South Africa, [2]Alimetrics Ltd, Helsinki, Finland

Ruminants fed high-concentrate diets run the risk of rumen acidosis, a disorder characterised by lactic acid accumulation and lowered rumen pH. Accumulation of lactic acid can be inhibited by increasing the number and activity of lactic acid utilising bacteria, as demonstrated in previous studies with Megasphaera elsdenii NCIMB 41125 (MeCH4). Use of this organism as a probiotic requires certainty that it is not inhibited by prophylactic antibiotics still included in ruminant feeds in many countries outside the EU. The objective of this study was to look at the interaction between various economic important in-feed antibiotics and MeCH4.

An in vitro batch fermentation model using 1 gram of substrate DM (50% corn silage, 25% barley meal, 25% soy meal) in 40 ml buffered rumen digesta was used. Anaerobic incubation lasted 9 hours at 37°C. Each antimicrobial compound tested was incubated with or without addition of MeCH4, and was added at two levels, selected to give 15 and 35% inhibition of total gas production, respectively. Zinc Bacitracin (0.1 and 0.5mg), Flavomycin (2 and 5mg), Virginiamycin (0.005 and 0.015mg) and Tylosin (0.2 and 1.0 mg) were tested (amount per 40 ml incubation in parentheses). Gas production kinetics, pH, short chain fatty acids, total bacteria and M. elsdenii were measured.

MeCH4 greatly reduced ($P<0.001$ in all cases) the residual level of lactic acid both in the presence and absence of antibiotics. All antibiotics reduced overall bacterial activity, however, addition of MeCH4 significantly ($P<0.05$) increased activity, as measured by gas production, in each case.

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Abderzak Lettat[1,2], Pierre Nozière[1], Mathieu Silberberg[1], Diégo P. Morgavi[1], Cécile Martin[1]
[1]INRA, UR1213 Herbivores, Clermont Ferrand - Theix, France, [2]Danisco SAS, Dangé St Romain, France

Ruminal acidosis is a recurrent problem in ruminant production systems. The prevailing fermentation acid is difficult to predict in practice and it is thought to be the reason for the variable effectiveness of some rumen modifiers. We developed a sheep model of experimentally-induced lactic, butyric or propionic acidosis to describe the associated changes in the rumen microbiota. Twelve rumen-cannulated sheep separated into 3 groups of 4 animals were fed a hay:concentrate diet (80:20) during 3 weeks followed by three consecutive days of acidosis challenge by direct intraruminal supply (1.2% BW) of ground wheat, maize or beet pulp. Rumen contents were analysed for fermentation parameters and polysaccharidase activities. Populations of *Fibrobacter succinogenes*, *Streptococcus bovis*, Lactobacilli and *Prevotella* were quantified by qPCR.

At the end of the challenge, rumen pH was lower for wheat (4.87) than for maize (5.17) and beet pulp (5.55). Lactate was predominant for wheat (33.8 mM vs. ~3 mM for other challenges), whereas beet pulp and maize favoured a high molar percentage of propionate (22.5%) and butyrate (16.9%), respectively. Fibrolytic activity and *F. succinogenes* proportion were similar among treatments. Amylase activity was highest for wheat, intermediate for maize and lowest for beet pulp. Lactobacilli and *S. bovis* proportions tended to be highest for wheat (1.74 vs. ~0.12%; $P = 0.15$) and maize (0.49 vs. ~0.05%; $P=0.17$) respectively, whereas Prevotella was highest for beet pulp (49 vs. ~29%). This study demonstrated that, feed-induced lactic, butyric or propionic acidosis were associated with a specific change in the bacterial population.