

Effect of prolonged feeding of a sainfoin (*Onobrychis viciifolia* Scop.) based diet on methanogenic community in the rumen of dairy cows

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Introduction

Condensed tannins present in sainfoin (*Onobrychis viciifolia* Scop.) can reduce methane emission by inhibiting the methanogenic activity in the rumen (Waghorn et al., 2002), either by reducing protozoa number or by changing the rumen fermentation activity. A reduction in methane production could be associated with a change in the number and/or in the diversity of the bacterial community in the rumen. The aim of present work was to study the effect of sainfoin tannins on rumen fermentation and on methanogen functioning and to assess adaptive behaviour of rumen microbiota.



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Material and Methods

Three rumen fistulated Holstein Friesian dairy cows were placed on a lucerne based 'uniformity diet' for a two-week period, after which the lucerne was exchanged for sainfoin. During the first five days of the sainfoin feeding polyethylene glycol (PEG4000) was administered by fistula to block the effect of condensed tannins. Thereafter, animals were continued on the sainfoin based diet for 8 more weeks. Samples of rumen liquid were collected and analysed on:

- ciliate protozoa by microscopic enumeration (Dehority, 1984);
- methanogenic Archea determined by qPCR assay (Denman et al., 2007);
- diversity in the rumen methanogen population by DGGE (Skillman et al., 2006);
- volatile fatty acids (VFA) by GC;
- ammonia (NH₃) by colorimetric method.

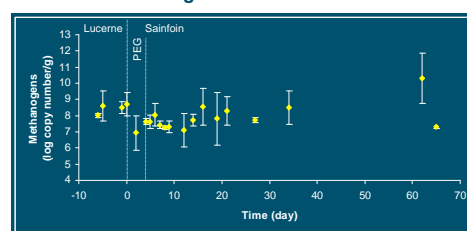
Data was analysed using the GLM procedure of SAS 9.1 (SAS Institute Inc., Cary, North Carolina, USA).

Results

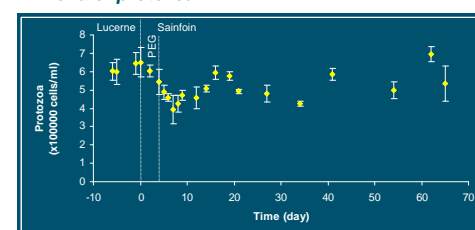
Treatment	Archea (log copy n/g)	Protozoa (x10 ⁵ cells/ml)	tVFA (mM)	BCP* (%)	NH ₃ (mg/l)	NGR* (mM/mM)
Lucerne	8.02	6.01	123.4	2.70	115.5	4.83
Lucerne	8.59	6.00	130.0	2.30	147.2	5.01
Lucerne	8.51	6.46	120.0	2.21	152.0	4.81
Sainfoin + PEG	8.72	6.51	119.1	2.15	88.9	4.92
Sainfoin + PEG	6.93	6.03	130.5	2.01	90.5	4.54
Sainfoin + PEG	7.64	5.45	117.9	1.79	76.7	4.33
Sainfoin wk 1	7.64	4.88	95.1	1.83	57.4	4.78
Sainfoin wk 1	8.05	4.59	99.8	2.04	63.1	4.81
Sainfoin wk 1	7.44	3.93	95.4	1.35	51.0	4.67
Sainfoin wk 1	7.26	4.23	92.6	2.14	64.6	4.48
Sainfoin wk 1	7.32	4.72	95.4	1.84	35.8	4.91
Sainfoin wk 2	7.11	4.58	98.2	2.32	94.2	4.30
Sainfoin wk 2	7.72	5.09	111.6	2.34	119.2	4.14
Sainfoin wk 2	8.54	5.96	134.5	1.90	114.1	4.17
Sainfoin wk 3	7.82	5.75	101.1	2.25	114.9	4.66
Sainfoin wk 3	8.30	4.92	119.1	2.23	107.2	4.46
Sainfoin wk 4	.	.	97.4	1.98	61.2	4.84
Sainfoin wk 4	7.71	4.80	96.3	1.89	109.1	5.27
Sainfoin wk 5	8.51	4.25	117.8	2.14	118.8	4.51
Sainfoin wk 6	.	5.86	112.6	2.02	53.0	5.29
Sainfoin wk 7	.	.	112.4	2.29	98.7	4.96
Sainfoin wk 8	.	4.99	96.0	2.14	57.4	5.08

* BCP = proportion of branched chain volatile fatty acids; NGR = non-glucogenic to glucogenic ratio

Trend of methanogens



Trend of protozoa



Conclusions

The tannin content in *Onobrychis viciifolia* Scop. resulted in the inhibition of protozoa and number of methanogens. The tendency of the different parameters suggests that the microbial population (protozoa, Archea and other bacteria) respond in different ways to the sainfoin diet over time, suggesting that rumen microbiota adapt to the dietary conditions. Further work is required to evaluate the relation between the microbial inhibition and methane production.

References

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Further information

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Acknowledgements

HEALTHYHAY
Worldwide Research Training Network
This work was financially supported by the EU,
HealthyHay (MRTN-CT-2006-035805)