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Methane reduction effect of simple phenolic acids evaluated by *in vitro* Hohenheim gas production method (Effekt einfacher Phenolsäuren auf die Methanreduktion *in vitro*) A. Jayanegara*, H. P. S. Makkar and K. Becker – Hohenheim

Methane production from ruminants contributes substantially to total global methane production, which is an important contributor to global warming. Six simple phenolic acids (benzoic, cinnamic, phenylacetic, caffeic, p-coumaric and ferulic acids) were evaluated for their potential to reduce enteric methane production *in vitro*.

Methods: Approximately 380 mg hay diet was incubated with 30 ml of buffered medium containing rumen liquor using the *in vitro* Hohenheim gas production method (1). Benzoic, cinnamic, phenlyacetic, caffeic, p-coumaric and ferulic acids at two levels (2 and 5 mM) were added to hay diet before the *in vitro* incubation. The simple phenolic acids were prepared by solubilizing the phenols in sodium phosphate buffer pH 6.7 to avoid pH>7.5 (since phenolics get oxidized in alkaline conditions), and adding 130 µl of NaOH (10 M) to completely dissolve the phenols. Each treatment was done in duplicate. The measured variables were gas production, methane, organic matter digestibility (OMD), and short chain fatty acids.

Results: At 2 mM, all the simple phenolic acids evaluated were not effective in decreasing methane production (Table 1). At 5 mM, benzoic and phenylacetic acids were not effective; however, cinnamic, caffeic, p-coumaric and ferulic acids decreased methane production significantly ($P<0.05$). Caffeic acid at 5 mM was most effective and it decreased methane production by 6.3%. The extent of reduction was higher (9.4%) when expressed as decrease of methane per unit organic matter digested. After caffeic acid, the order of simple phenols to decrease methane production was: p-coumaric > ferulic > cinnamic. The addition of simple phenols did not significantly decrease OMD; however, it tended to decrease total SCFA production. Significant reduction in SCFA was observed by caffeic and p-coumaric addition at 5 mM ($P<0.05$).

Table 1. Effect of simple phenolic acids addition on some rumen fermentation parameters

Treatment	Conc (mM)	Gas (ml)	CH_4 (ml/100ml)	OMD (%)	CH_4/OMD (ml/100mg)	T-SCFA (mM)	i-SCFA (mM)	C_2/C_3
Control	-	76.2^{c}	15.9^{cd}	76.1	5.05^{bc}	49.79^{b}	0.52^{ab}	2.75
Benzoic	2	77.0^{c}	16.0^{cd}	75.2	5.19^{c}	50.79^{b}	0.61^{b}	2.73
	5	74.8^{bc}	16.0^{cd}	75.2	5.03^{abc}	45.53^{ab}	0.45^{ab}	2.71
Cinnamic	2	75.3^{bc}	15.5^{abc}	75.7	4.88^{abc}	45.64^{ab}	0.46^{ab}	2.69
	5	74.5^{bc}	15.4^{abc}	75.5	4.79^{abc}	46.17^{ab}	0.47^{ab}	2.70
Phenylacetic	2	73.3^{abc}	15.9^{bcd}	73.7	5.00^{abc}	44.70^{ab}	0.43^{ab}	2.67
	5	74.3^{bc}	16.4^{d}	75.1	5.13^{c}	44.94^{ab}	0.48^{ab}	2.75
Caffeic	2	73.3^{abc}	15.6^{abc}	73.2	4.94^{abc}	46.06^{ab}	0.51^{ab}	2.74
	5	71.0^{ab}	14.9^{a}	73.4	4.57^{a}	43.33^{a}	0.43^{ab}	2.73
p-Coumaric	2	72.5^{abc}	15.5^{abc}	71.8	4.96^{abc}	47.21^{ab}	0.52^{ab}	2.74
	5	68.5^{a}	15.1^{a}	71.0	4.61^{ab}	42.38^{a}	0.36^{a}	2.71
Ferulic	2	72.5^{abc}	15.9^{bcd}	75.2	4.84^{abc}	46.75^{ab}	0.55^{ab}	2.75
	5	70.8^{ab}	15.2^{ab}	71.4	4.77^{abc}	45.14^{ab}	0.43^{ab}	2.73
SEM		0.49	0.08	0.43	0.039	0.507	0.014	0.008

Conclusions: Methane decrease by addition of phenolic acids was relatively small (up to 9.4%), and the effect of phenolic acids on methane decrease depended on the source and concentration applied.

1. MAKKAR, HPS, BLÜMMEL, M and BECKER, K. (1995). Brit. J. Nutr. 73, 897-913.

* Institute of Animal Production in the Tropics and Subtropics, University of Hohenheim, Fruwirthstr. 12, 70599 Stuttgart, Email: inst480b@uni-hohenheim.de