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Effects of additives with antioxidant activity on *in vitro* rumen fermentations of two feeds

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INTRODUCTION

❖ Manipulation of rumen fermentation using bioactive compounds extracted from vegetables is a developing research area

❖ Few information is available about the possibility to influence rumen fermentation by addition of vitamins and/or natural compounds extracted from agricultural products

❖Wine marc extracts contain large amount of polyphenols with antioxidant and antimicrobial properties

AIM

❖ To evaluate the effects of ascorbic acid (AA), α-tocopherol (α-T) and wine marc extract (WME) on *in vitro* rumen fermentations

MATERIAL AND METHODS

❖ Meadow hay (MH) and corn meal (CM) were incubated *in vitro* with 25 ml of rumen fluid and 50 ml of Menke buffer, using an automatic gas production (GP) system (RF, Ankom Technology®)

❖ In the 1° incubation each feed (0.5 g), milled at 1 mm, was analyzed in quadruplicate for 48 h at 39°C without any additive (C) or with 0.01 g of ascorbic acid (AA), α-tocopherol (α-T) or wine marc extract (WME)

❖A 2° incubation, performed using the same experimental design described above, was stopped at the time at which half of asympotic GP was produced (t½), which were 16 and 9 h respectively for MH and CM

❖ Data of GP were fitted with the model: $GP(t) = A/(1+(t½ / t)^c)$, where A is the asymptotic GP, t½ is the time at which half of A is produced and c is the sharpness of the curve profile

❖ Residual fluids of the 2° incubation were analyzed for VFA, NH_3, and for N balance

❖ To determine N balance residual fluids were treated with methyl-cellulose and centrifuged 6 times at 150 *g* for 6 min to separate microbes (supernatant) from feed particles (pellet)

❖ Microbial N (N-MO) was computed as: N-MO (mg/jar) = N supernatant – $N\text{-}NH_3$, where N supernatant is the N content of the supernatant and $N\text{-}NH_3$ is the ammonia content of supernatant

❖ Efficiency of microbial production (EMP) was computed as: EMP = N-MO / GPt½, where GPt½ is the GP measured at t½. EMP was expressed as mg of N-MO apparently retained / 100 ml of gas

❖ All the data were submitted to ANOVA, considering the feed, the additive and their interaction as sources of variation

CONCLUSIONS

❖Results indicated the use of these additives could exert some effects on rumen fermentation.

❖Ascorbic acid did not shown relevant effects, it increased GP likely because of its acidifying properties (indirect GP)

❖ α-tocopherol altered rumen fermentation, but the results were different for different feeds

❖ Wine marc extract inhibited feed fermentation (GP and VFA) and apparently increased efficiency of microbial production on both the feeds

RESULTS

❖ The two feeds showed significant differences for kinetic of GP, VFA profile, NH_3 content and efficiency of microbial production (Table 1; Figure 1-2).

❖ The three additives did not affect significantly the molar proportions of VFA at t ½

❖ Ascorbic acid increased significantly GP but did not affected the end product of fermentation and the N balance.

❖ α-tocopherol increase significantly the amount of $N\text{-}NH_3$ at the end of the fermentation only when incubated with MH

❖ Wine marc extract slowed down kinetics of the GP and reduced total GP in incubation with MH. At t½ this extract changed VFA profile and improved significantly EMP

Figure 1. Kinetics of gas production (GP)

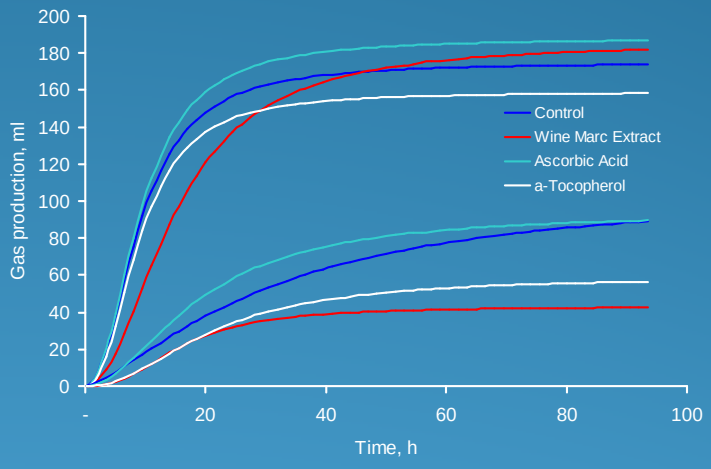

Figure 2. Efficiency of microbial production (EMP)

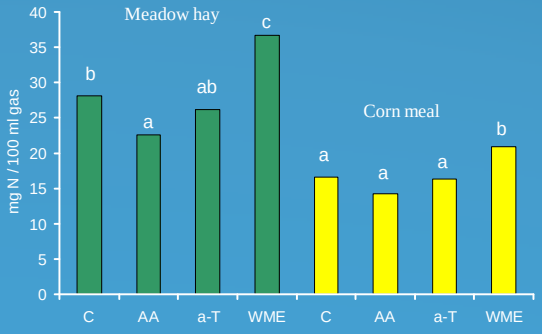

Table 1. Volatile fatty acids (VFA) profile and nitrogen balance

	Meadow hay (MH)				Corn meal (CM)				SE
	C	AA	α-T	WME	C	AA	α-T	WME	
Acetate, %	63.5^{AB}	63.2^{B}	62.7^{B}	65.5^{A}	54.8^{AB}	54.0^{B}	53.9^{B}	56.7^{A}	1.3
Propionate, %	19.5^{AB}	20.2^{A}	20.0^{A}	16.3^{B}	22.6	24.7	24.3	23.9	2.1
n-butyrate, %	10.7	11.3	11.9	10.7	15.2^{A}	15.0^{A}	15.0^{A}	11.9^{B}	0.9
Others VFA, %	6.3	5.3	5.4	7.5	7.4	6.3	6.8	4.4	0.7
Total N (mg)	20.3	20.2	20.5	19.8	20.5	19.8	19.7	19.7	0.4
N-pellet (mg)	3.4	4.0	3.7	3.7	6.9	6.0	5.9	7.2	0.8
$N\text{-}NH_3$ (mg)	5.6^{B}	5.4^{B}	7.7^{A}	6.1^{B}	3.0^{AB}	2.5^{B}	3.2^{AB}	3.8^{A}	0.3
N-MO (mg)	11.3^{a}	10.8^{ab}	9.2^{b}	10.0^{ab}	10.6^{ab}	11.3^{a}	10.7^{ab}	8.7^{b}	0.8

Within each feed means with different letters in the same row are different: a,b $P<0.05$; A,B $P<0.01$

C= Control; AA= Ascorbic Acid; α-T= α-Tocopherol; WME= Wine Marc Extract

Within each feed bars with different letters are different: a,b, c $P<0.05$

C= Control; AA= Ascorbic Acid; α-T= α-Tocopherol; WME= Wine Marc Extract