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Effect of a folic acid and pantothenic acid supplementation on ruminal metabolism and nutrient flow at the duodenum

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Introduction

Folic acid (FA) is essential for cell division and protein metabolism. Pantothenic acid (PA), as a part of coenzyme A and acyl-carrier-protein, is very important for several biochemical pathways. So far it was assumed that adequate quantities of FA and PA are synthesised by ruminal microorganisms. But it is doubtful if this synthesis is sufficient under present feeding regimes. Thus, for dairy cows an FA and PA supplementation may be beneficial. The objective of this study was to compare the effects of an FA, respectively a PA supplementation on ruminal metabolism at different forage:concentrate ratios.

Material and Methods

Animals:

- 7-9 Friesian cows with cannulas in the rumen and duodenum (dry or 182 ± 101 days in milk resp.)

Ration:

- concentrate (C): wheat, maize, soybean meal, dried sugar beet pulp, peas, urea, mineral + vit. (exl. FA and PA)
- forage (F): 60% maize- + 40% grass-silage (DM-basis)
- 1. Trial: ⅔ C + ⅓ F
- 2. Trial: ⅓ C + ⅔ F

➡ Both trials without or with 1 g FA resp. PA per cow and day

Organic matter intake (OMI):

- Mean: 11.3 ± 3.3 kg / d
- Range: 5.1 – 16.7 kg / d

Sample collection:

- ruminal fluid: on 1 d/period before and 6 times after first morning feeding
- duodenal chyme: 5 days/period, every 2 h

Flowmarker: Cr_2O_3

Microbial protein: measured by NIRS

Results

Table 1: Influence of FA and PA supplementation on ruminal parameters over all sampling times (LSmeans)

	⅔ C + ⅓ F			⅓ C + ⅔ F			⅔ C + ⅓ F			⅓ C + ⅔ F		
	-FA	**+FA**	**P**	**-FA**	**+FA**	**P**	**-PA**	**+PA**	**P**	**-PA**	**+PA**	**P**
(n)	(7)	(7)		(8)	(8)		(8)	(8)		(9)	(9)	
pH	6.3	6.3	0.95	6.4	6.4	0.48	6.3	6.4	0.23	6.4	6.4	0.86
NH_3 (mmol/L)	10	9	0.19	10	10	0.74	10	10	0.70	10	10	0.13
Acetic acid (mol %)	61	60	0.57	63	63	0.38	61	62	**0.04**	64	64	0.68
Propionic acid (mol %)	19	19	0.95	19	18	0.15	19	18	0.15	18	17	**<0.01**
Butyric acid (mol %)	15	15	0.24	14	15	0.10	15	15	0.18	14	14	0.84
SCFA (mmol/L)	97	96	0.71	109	105	0.46	96	91	0.09	109	107	0.62

Table 2: Influence of FA and PA supplementation on fermented organic matter (FOM), apparent ruminal digestibilities (ARD), ruminal undegradable protein (UDP) and utilizable crude protein (uCP) flow at the duodenum and microbial protein (MP) synthesis (LSmeans)

	⅔ C + ⅓ F			⅓ C + ⅔ F			⅔ C + ⅓ F			⅓ C + ⅔ F		
	-FA	**+FA**	**P**	**-FA**	**+FA**	**P**	**-PA**	**+PA**	**P**	**-PA**	**+PA**	**P**
(n)	(7)	(7)		(8)	(8)		(8)	(8)		(9)	(9)	
FOM (% of OMI)	62	59	0.06	56	58	0.29	61	60	0.71	55	58	**0.01**
ARD of NDF (%)	45	43	0.48	48	50	0.42	45	45	0.93	48	49	0.61
ARD of ADF (%)	40	39	0.95	48	52	**0.03**	40	44	0.07	48	49	0.51
MP/ FOM (g/kg)	180	168	0.12	159	149	0.37	186	165	**0.01**	165	158	0.56
UDP (% of CP)	23	23	0.20	25	26	0.65	22	23	0.67	24	26	0.43
uCP (g/d)	1837	1704	0.09	1341	1335	0.95	1946	1740	0.14	1316	1367	0.53

Conclusion

FA and PA had no or only minor influences on ruminal parameters, as well as on nurtient flow at the duodenum.