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Effects of exogenous Yucca plant powder supplementation on in vitro rumen fermentation characteristics of lactating dairy cowse

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INTRODUCTION

- Using additives to regulate the fermentation degradation rate of nutrients in the rumen is one of the directions to improve the feed utilization rate of lactating dairy cows
- At present, the effect of yucca plant powder on rumen fermentation and reduction of ammonia nitrogen content has been confirmed, but the appropriate dosage of yucca plant powder is still uncertain.

OBJECTIVE

- This study aims to investigate the effect of different doses of Yucca plant powder on rumen fermentation parameters in vitro
- It provides a theoretical basis for the application of yucca plant powder as a feed additive in dairy cow production.

MATERIALS & METHODS

- rumen fluids were collected from 4 lactating Holstein cows with fistula, and a lactating diet was used as the fermentation substrates
- Five groups were classified based on different levels of Yucca plant powder as follows: 0 (control), 2.5, 5, 7.5, and 10 g/kg (dry matter basis), and each treatment was performed in 6 replicates
- The AGRS-Ⅲ microbial fermentation microgas production auto-recorder was used to perform in vitro fermentation at 39 ℃ for 48 h.
- Using PROC ANOVA in SAS9.4 software for one-way analysis of variance, using Duncan's method for multiple comparisons, using GLM model for linear and quadratic statistical analysis, the significance level was P≤0.05.

RESULTS

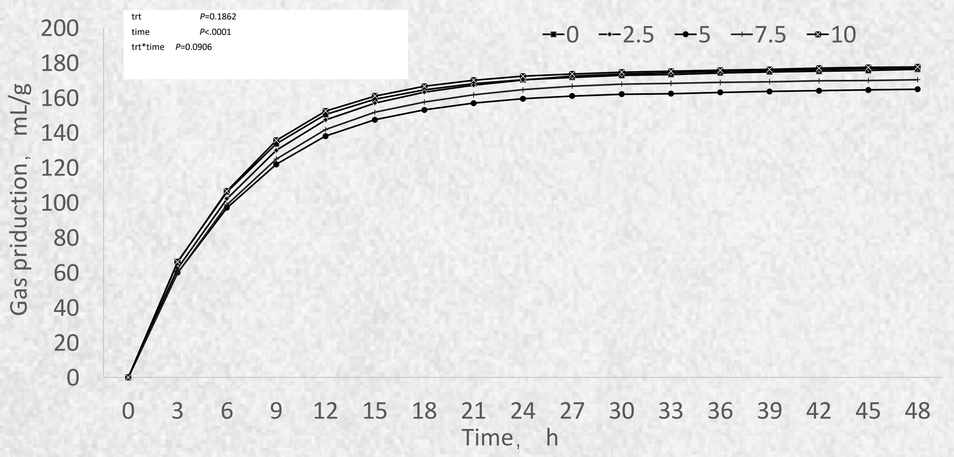

Fig.1 Effects of Yucca plant powder on total gas production in vitro rumen fermentation （48 h）

Table 1 Effects of *Yucca* plant powder on rumen fermentation parameters *in vitro* (48 h)

Items	*Yucca* plant powder supplementation level/(g/kg)					SEM	*P*-value		
	0	2.5	5.0	7.5	10.0		ANOVA	Linear	Quadratic
pH	6.73	6.74	6.77	6.69	6.74	0.020	0.12	0.67	0.71
NH_3-N/(mg/dL)	34.25	37.56	29.98	32.91	34.89	1.689	0.06	0.51	0.25
Total VFA/(mmol/L)	68.80	64.98	65.39	72.69	80.63	4.416	0.17	0.05	0.10
Acetate/(mmol/L)	43.83	41.29	41.85	46.42	51.81	3.504	0.19	0.05	0.12
Propionate/(mmol/L)	12.92	12.32	12.25	13.53	15.32	0.852	0.15	0.04	0.10
Butyrate/(mmol/L)	6.46	5.97	5.89	6.82	7.53	0.430	0.13	0.05	0.06
Isobutyrate/(mmol/L)	0.480	0.482	0.442	0.520	0.568	0.035	0.25	0.09	0.16
Valerate/(mmol/L)	0.876	0.799	0.787	0.902	1.003	0.061	0.19	0.10	0.06
Isovalerate(mmol/L)	0.880	0.793	0.760	0.881	1.021	0.062	0.11	0.09	0.02
A/P	3.35	3.32	3.40	3.33	3.38	0.060	0.90	0.76	0.95

Table 2 Effects of Yucca plant powder on nutrient degradation rate of in vitro rumen fermentation (48 h) %

Items	*Yucca* plant powder supplementation level/(g/kg)					SEM	*P*-value		
	0	2.5	5.0	7.5	10.0		ANOVA	Linear	Quadratic
DMD	91.3	89.1	87.3	92.6	90.1	1.42	0.18	0.59	0.19
CPD	93.3	90.2	94.1	94.8	92.8	—	—	—	—
NDFD	80.4	75.2	84.6	83.4	80.1	—	—	—	—
ADFD	76.5	70.2	82.1	80.3	76.3	—	—	—	—

Table 3 Effects of Yucca plant powder on gas production of in vitro rumen fermentation (48 h)

Items	*Yucca* plant powder supplementation level/(g/kg)					SEM	*P*-value		
	0	2.5	5.0	7.5	10.0		ANOVA	Linear	Quadratic
Gas production/(mL/g)	111.7	113.3	108.9	111.6	113.2	3.83	0.94	0.91	0.13
Methane production/(mmol/L)	18.76	17.58	17.82	19.81	22.11	1.304	0.20	0.05	0.11

RESULTS AND CONCLUSION

- Concentrations of total volatile fatty acids, acetic, propionic and butyrate of the fermentation broth increased linearly with the increased doses of Yucca plant powder.
- The addition of 5 g/kg Yucca plant powder had a certain inhibitory effect on the ammonia nitrogen production in vitro without significant difference compared with the control group.
- The addition of Yucca plant powder had no significant effect on the dry matter degradation rate.
- Adding 5 g/kg Yucca plant powder for 48h had the lowest gas production in vitro, but there was no significant difference. Besides, 2.5 g/kg Yucca plant powder had the lowest methane production in vitro for 48 h, but did not reach a significant difference compared to the control group.
- Data suggest that Yucca plant powder at a level at 5.0g/kg in diet has the potential to reduce methane emissions and reduce the concentration of ammonia nitrogen in vitro fermentation, decrease rumen degradation of diets.

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