Dose-response effects of chitosan extracts on ruminal degradation and fermentation of a high concentrate ration.

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Introduction

Chitosan is a non-toxic and biodegradable carbohydrate polymer that has received much attention as a functional biopolymer for diverse applications in medicine and food preservation, due to its antimicrobial properties. The objetive of this work was to study the **dose-response effects** of chitosans, with different molecular weights and deacetylation degrees, **on ruminal digestion and fermentation parameters of a ration rich in concentrate.**

Material and methods

➢ Additives and Ration

☑ Four different doses: 0 (control), 325, 750 and 1500mg/l of culture fluid

☑ 20:80 alfalfa hay: concentrate ration (91% DM; 92.5%OM, 21.4%CP, 32.2%NDF, 13.9%ADF, and 3%FAT, DM basis)

Table 1. Physical characteristics of the tested additives

Additives

Abbreviation	Commercial name	Deacetylation degree (%)	Viscosity (m Pa s)	Source
CHI1	75-200	75	200	Biolog, S:A
CHI2	85-200	85	200	Biolog, S:A
CHI3	Fg 95	>95	<500	Trades S.A.

➢ Procedures and Statistics

☑ Gas production technique. 24h incubations, in triplicate in two different periods.

☑ Data analyzed as a **factorial design** (3 additives x 4 doses) with PROC GLM procedure of SAS.

Model: $\mathbf{Y}ijk = \mu + \mathbf{A}i + \mathbf{D}j + (\mathbf{AxD})ij + \varepsilon ijk$, in wich $\mathbf{Y}ijk$: the value of each individual observation, μ: the average, $\mathbf{A}i$: the effect of the ith additive (i = CHI1, CHI2, or CHI3), $\mathbf{D}j$: the effect of the jth dose of the additive (j = 0, 325, 750, or 1,500 mg/l of culture fluid), and εijk: the residual error.

☑ Differences between means were declared at $P<0.05$.

Results and conclusions

	Dose (mg/l)	pH	IVTOMD, g/kg	Total VFA, mmol/gDM	*Individual, mmol/100 mmol*				C3:C2	CH_4, mmol	VFA:TDS, mmol/gDM	$N\text{-}NH_3$, mg/100 ml
					Acetate	Propionate	Butyrate	BCVFA				
Additive												
CHI1	0	6.44	857^{a}	5.77	59.6	17.9^{a}	16.1^{a}	3.73^{a}	0.30^{a,b}	0.90^{a,b}	7.33^{a}	26.6
	325	6.47	797^{b}	6.42	61.5	17.7^{a}	15.9^{a}	3.44^{a}	0.29^{b}	1.03^{a}	8.75^{b}	29.3
	750	6.47	727^{c}	6.25	59.9	21.2^{b}	14.7^{a}	3.36^{a}	0.36^{a}	0.94^{a}	9.35^{b}	25.4
	1500	6.46	702^{c}	5.77	59.9	26.4^{c}	10.5^{b}	2.18^{b}	0.45^{c}	0.78^{b}	8.93^{b}	30.8
CHI2	0	6.44^{a}	857^{a}	5.77	59.6^{a}	17.9^{a}	16.1^{a}	3.73^{a}	0.30^{a}	0.90^{a}	7.33^{a}	26.6
	325	6.47^{a}	785^{b}	5.64	57.1^{a,b}	21.2^{b}	16.3^{a}	3.60^{a}	0.37^{b}	0.84^{a}	7.80^{a}	28.9
	750	6.47^{a}	723^{c}	5.29	55.2^{b}	27.0^{c}	13.8^{a}	2.82^{b}	0.49^{c}	0.69^{b}	7.95^{a,b}	30.4
	1500	6.39^{b}	678^{d}	5.67	55.1^{b}	31.9^{d}	9.5^{b}	1.91^{c}	0.58^{d}	0.65^{b}	9.08^{b}	31.5
CHI3	0	6.44^{b,c}	857^{a}	5.77^{a}	59.6^{a}	17.9^{a}	16.1^{a}	3.73^{a}	0.30^{a}	0.90^{a}	7.33^{a,b}	26.6
	325	6.52^{a}	777^{b}	4.81^{b}	58.8^{a,b}	24.6^{b}	13.4^{a,b}	2.73^{b}	0.42^{b}	0.67^{b}	6.74^{b}	32.8
	750	6.46^{b}	733^{c}	5.66^{a,b}	54.9^{b,c}	29.3^{c}	12.1^{b}	2.51^{b}	0.54^{c}	0.70^{b}	8.37^{a}	26.0
	1500	6.40^{c}	685^{d}	5.27^{a,b}	53.6^{c}	35.0^{d}	8.2^{c}	1.31^{c}	0.65^{d}	0.55^{b}	8.35^{a}	17.8
	SEM	0.02	9.7	0.31	1.61	0.97	1.19	0.27	0.02	0.05	0.45	5.32
Effects	Additive	ns	ns	*	**	***	ns	**	***	***	*	ns
	Dose	**	***	ns	*	***	***	***	***	***	**	ns
	Additive x Dose	*	ns	ns	ns	**	ns	ns	**	*	ns	ns

✔ Chitosan modified rumen fermentation pattern of a 20:80 alfalafa hay:concentrate ration, shifting fermentation to energetically more efficient routes in a dose-dependant manner.

✔ CHI3 (95% deacetylation degree) exerted the most promising results.