Ruminant physiology

Digestion, metabolism, and effects of nutrition on reproduction and welfare

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In vitro first order dry matter disappearance kinetics of guar meal

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Introduction

The guar plant is grown for the guar bean's gum that has many food and industrial applications. Isolation of gum (a galactomannan) from guar seed led to yield a high protein by-product containing 55 to 60 percent crude protein (CP), which has been used as a protein source in ruminant and non-ruminant livestock feeding. However, information about the kinetics of nutrient disappearance of guar meal in ruminants is very low. The aim of the present study was to evaluate *in vitro* first order dry matter (DM) disappearance kinetics of guar meal.

Material and methods

Samples of guar meal as non-heat processed (CP: 566 and 580 g/kg DM; GM566 and GM580, respectively) and heat processed (CP: 594 g/kg DM; GM594P) were provided. They were dried using a forced-air oven at 60 °C for 48 h. All feed samples were ground to pass through a 2-mm screen and then analysed for crude protein (CP), ether extract (EE) and ash (AOAC, 1995). Neutral detergent fibre (NDF) and acid detergent fibre (ADF) were determined using the method of Van Soest *et al.* (1991). Samples were incubated in a medium prepared as described by Arroquy *et al.* (2005). Fifty-five ml of medium were supplied into 100 ml bottles that approximately contained 0.45 g of feed (6 replicate for each feed). Then, each bottle was inoculated under carbon dioxide with 5 ml of mixed rumen microbes. Rumen fluid was obtained from three sheep (49.5±2.5 kg) fitted with rumen fistulae, before the morning feeding, and immediately strained through four layers of cheesecloth. The animals fed 1 kg/d of DM of lucerne hay and 0.3 kg/d of DM concentrates (165 g CP/ kg of DM). The bottles were incubated for 4, 8, 16 and 24 h at 39 °C. Then, bottle content was filtered through a 42 µm filter, and DM of the unfiltered medium was determined. Non-linear first order model was used to estimate the digestion kinetic parameters of DM. The model was the following: $D_{(t)} = D_{(i)}.exp\ (-kd.\ time) + I$; Where, $D_{(t)}$ is the residual DM at any time, $D_{(i)}$ is the potentially digestible fraction, *kd* is the fractional rate constant of digestion (/h) and *I* is the indigestible fraction.

Results

The chemical compositions of the samples are shown in Table 1. Non-linear first order parameters of *in vitro* DM digestion of the samples are presented in Table 2. The results of the present study indicate that DM of various guar meals, except for GM60P, were completely digestible. The *kd* was significantly ($P<0.05$) higher in GM566 compared with G580 and GM594P.

Table 1. Chemical compassion of the samples (g/kg).

Feed	Nutrients			
	EE	NDF	ADF ADF	Ash
GM566	36.6	218.0	131.0	52.0
GM580	75.2	205.0	144.0	50.9
GM594P	71.9	238.0	140.0	51.7

Table 2. In vitro first order DM disappearance parameters of guar meal.

Feed	Parameters			
	Kd[1]	I[2]	Di[3]	R^2
GM566	0.13±0.007	0.0	1.02±0.02	0.99
GM580	0.108±0.005	0.0	1.04±0.017	0.99
GM594P	0.101±0.011	0.07±0.03	0.91±0.035	0.95

[1] Fractional rate constant of digestion (/h).
[2] Indigestible fraction.
[3] Potentially digestible fraction.

Conclusion

The results of the present study demonstrated that *in vitro* DM indigestible fraction of various guar meals is influenced by heat processing. While the DM of GM566 and GM580 completely disappeared after 24 h of incubation, about 7% of DM of GM594P remained in the medium. It was also concluded that the rate of DM disappearance of GM566 was higher than that of the other samples.

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