

Disappearance of dry matter and neutral detergent fibre (NDF) of sunflower meal treated with sodium hydroxide or formaldehyde by isolated mixed rumen bacteria using *in vitro* culture

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Introduction Cellulolytic bacteria, such as *Ruminococcus albus*, *R. flavefaciens* and *Fibrobacter succinogenes* are major micro-organisms responsible for ruminal digestion of plant cell walls ingested by the animal due to their numerical predominance and metabolic diversity (Cheng *et al.*, 1991). It has been proposed that sodium hydroxide might breakdown hemicelluloses, expose the cellulose to microbial attachment and improve digestibility (Chen *et al.*, 2006). The objective of this experiment was to estimate the disappearance of dry matter (DM) and neutral detergent fibre (NDF) of sunflower meal (25 g fat/kg DM; SM) as untreated or treated with formaldehyde (3 g/kg DM) or sodium hydroxide (40 g/kg DM) using *in vitro* culture with isolated mixed rumen bacteria.

Materials and methods Rumen fluid was collected from four fistulated sheep which fed 250 g concentrate, 550 g lucerne hay and 200 g wheat straw, then centrifuged (1000 rpm, 10 min). Supernatant was used to grow bacteria in bacteria medium containing fungicides (benomyl: 500 ppm/ml of medium and metalaxyl: 10 mg/ml of medium) under anaerobic conditions at 39 °C for 24 h. These isolates were then used as a source of inoculum for culturing bacteria in a serum bottle containing 45 ml of culture medium of bacteria (Galdwell and Bryant, 1966) and 1g of SM as untreated or treated with formaldehyde (3 g/kg DM) or sodium hydroxide (40 g/kg DM) under anaerobic conditions (using three times subculture), at 39 °C in an incubator for 12, 24, 48, 72 and 96 h. Three replicates were run per treatment per time. The residual substrates of each bottle were then filtered and used to determine the DM and NDF concentrations. Data for DM and NDF disappearance in different times were analysed as a completely randomised design using the General Linear Model (GLM) procedure of SAS (1990). Duncan's multiple range test was used to compare the means at $P < 0.05$.

Results Disappearance of DM and NDF of samples using isolated mixed rumen bacteria culture are given in Table 1. Disappearance rate of DM and NDF of sodium hydroxide treated samples was markedly higher than the other samples, in each incubation time. Formaldehyde caused a decrease in the disappearance of DM and NDF of SM using rumen mixed bacterial *in vitro* culture.

Table 1 Dry matter (DM) and neutral detergent fibre (NDF) disappearance of sodium hydroxide or formaldehyde treated sunflower meal using isolated rumen bacteria *in vitro* culture

IT (h)	DM disappearance (g /100g)					NDF disappearance (g/100 g)				
	USM	SHSM	FSM	s.e.m	P	USM	SHSM	FSM	s.e.m	P
12	36.3 ^b	42.0 ^a	31.2 ^c	0.77	< 0.01	10.1 ^b	14.5 ^a	8.3 ^c	0.51	< 0.01
24	42.6 ^b	47.1 ^a	33.4 ^c	0.65	< 0.01	19.5 ^b	21.3 ^a	15.9 ^c	0.72	< 0.01
48	51.1 ^b	58.2 ^a	44.2 ^c	0.79	< 0.01	26.5 ^b	29.6 ^a	23.3 ^c	0.80	< 0.01
72	59.2 ^b	67.1 ^a	54.1 ^c	0.87	< 0.01	28.2 ^b	31.0 ^a	24.4 ^c	0.84	< 0.01
96	57.3 ^b	62.3 ^a	56.3 ^b	0.62	< 0.01	27.7 ^b	30.6 ^a	23.7 ^b	0.72	< 0.01

IT: incubation time; USM: untreated sunflower meal (SM); SHSM: 40 g NaOH /kg DM of SM; FSM: 3 g formaldehyde /kg DM of SM; s.e.m: standard error of mean; abc: means with different letters within each row differed significantly.

Conclusions *In vitro* bacterial digestion of feed samples used in the present experiment was influenced by chemical compounds of sodium hydroxide or formaldehyde. Sodium hydroxide caused to increase the bacteria digestion of DM and NDF, while formaldehyde decreased the digestion using *in vitro* culture. Results of the present study confirmed previous results which used an alkaline solution to increase the disappearance rate of DM and NDF. Gould (1984) reported that the dilute solutions of alkaline react with lignocelluloses to yield partially de-lignified products that are highly susceptible to enzymatic and microbial attack. Bas *et al.* (1989) reported that the DM and NDF digestion of straw treated with an alkali was greater than untreated straw. Results of the present study indicated that the potential improvement in DM and NDF digestion of sunflower meal could be resulted from the use of sodium hydroxide.

References

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