Proceedings

of the British Society of Animal Science

2008

british society of animal science

Feedstuffs and Techniques

The degradation kinetic of NDF and lignin of sunflower meal containing low or high fat treated with sodium hydroxide

T. Mohammadabadi, M. Danesh Mesgaran, A. Heravi Mousavi, M.R. Nasiri, M. Chaji
Dept. of Animal Science, Excellence Center for Animal Science, Faculty of Agriculture, Ferdowsi University of Mashhad, P O Box 91775-1163, Mashhad, Khorasane-Razavi, Islamic Republic of Iran
Email:mohammadabadi2002@yahoo.com

Introduction Sunflower meal is a good source of protein and NDF for ruminants. The amount of hull or fibre in sunflower might affect the ruminal and post-ruminal digestion of this protein source. Available information on the effect of sodium hydroxide on degradation of NDF and lignin of sunflower meal is scarce. It has been proposed that sodium hydroxide may break down hemicellulose, hydrolyze the ester bonds between lignin and hemicellulose, swell cellulose microfibrils (Canale *et al*., 1992), expose the cellulose to microbial attachment and improve digestibility (Goto *et al*., 1993). The objective of this study was to investigate the effect of sodium hydroxide (NaOH) on chemical composition and *in situ* degradation characteristics of NDF and lignin of low and high fat sunflower meal (25 and 165 g/kg DM; LFSM and HFSM, respectively).

Materials and methods Experimental samples were: 1- Untreated LFSM (ULFSM), 2- NaOH treated LFSM (40 g/kg, DM, LFSM+SH); 3- Untreated HFSM (UHFSM) and 4- NaOH treated HFSM (40 g/kg, DM, HFSM+SH). Chemical composition (CP, Ash, lignin, NDF and ADF-ash) was determined using standard procedures (AOAC, 1990). Lignin and NDF degradation of the samples were determined using *in situ* technique in two fistulated Holstein steers (400±12 Kg, body weight). Animals were fed 8.8 kg of DM of a diet consisted of 40% concentrate (155 g CP kg^{-1} of DM; 30% maize, 34% barley, 8% soybean meal, 5% sugar beet pulp, 10% wheat bran, 12% cottonseed meal, 0.3% CaCo3, 0.5% mineral and vitamin premix, 0.2% salt), 30%lucerne hay and 30% maize silage. Samples were ground to pass through a 2-mm screen and placed (5 g DM) in polyester bags (10×20 cm, 50 µm pore size), then, incubated in the rumen for 0.0, 2, 4, 6, 8, 16, 24, 48, 72 and 96 h (n=8). Data of NDF and lignin degradation beyond the lag-time were further adjusted to a negative exponential model of $P= a+b(1-e^{-ct})$, where P= fraction degraded in the time t, a= rapidly degradable fraction, b= slowly degradable fraction, c= fractional degradation rate and t= incubation time. Data were analyzed using general linear model of SAS (1990) at $P< 0.05$.

Results Chemical composition of the samples is summarized in Table 1. Ruminal degradation parameters (a, b, c) of NDF and lignin are shown in Table 2. NaOH caused to increase fraction (b) of NDF of sunflower meals (low and high fat). The (b) fraction of lignin was also improved when samples were treated with sodium hydroxide.

Table 1 Chemical composition (g/kg DM) of sodium hydroxide treated sunflower meals

Chemical composition	Treatments*				
	ULFSM	LFSM+SH	UHFSM	HFSM+SH	s.e.m
CP	337.6^a	305.1^b	278^c	234.6^d	1.0
Ash	59.9^c	99.2^a	49.6^d	80.1^b	0.4
NDF	400^b	410^b	400^b	430^a	14
Lignin	93^b	126^a	83^b	130^a	6
ADF-ash	330^a	276^b	323^a	321^a	7

*Untreated LFSM (ULFSM); NaOH treated LFSM (40 g/kg, DM, LFSM+SH); Untreated HFSM (UHFSM); NaOH treated HFSM (40 g/kg, DM, HFSM+SH); s.e.m: Standard error of mean, Means with different letters within samples differed (P< 0.05)

Table 2 *In situ* NDF and lignin (mean ± SE) degradation coefficients (a, b, c) of sunflower meals

	NDF				Lignin			
	ULFSM	LFSM+SH	UHFSM	HFSM+SH	ULFSM	LFSM+SH	UHFSM	HFSM+SH
a	0.13±0.02	0.12±0.01	0.13±0.01	0.11±0.01	0.06±0.01	0.05±0.01	0.06±0.01	0.06±0.01
b	0.72±0.15	0.79±0.20	0.45±0.10	0.54±0.10	0.27±0.80	0.80±0.64	0.26±0.52	0.79±0.88
c	0.02±0.01	0.01±0.04	0.07±0.03	0.04±0.04	0.00±0.01	0.00±0.01	0.01±0.01	0.00±0.04

a*:* Rapidly degradable fraction; b*:* Slowly degradable fraction; c*:* Fractional degradation rate constant (h^{-1})

Conclusions Results of the present experiment indicated that the CP concentration of samples containing both fat were significantly decreased when they treated with NaOH (P< 0.05). Slowly degradable fraction (b) of NDF of ULFSM was higher than UHFSM, while, there was not difference in fraction (b) of lignin. It was concluded that NaOH caused to increase the degradation potential of sunflower meal. In addition, the potential degradation of NDF and lignin of sunflower meal might be affected by the fat concentration.

References

Canale, C.J., Glenn, B.P., and Reeves, J.B. 1992. Journal of Dairy Science. 75, 1543-1554.
Goto, M., Yokoe, Y., Takabe, K., Nishikawa, S., and Morita, O. 1993. Animal Feed Science and Technology. 40, 207–221.