

Proceedings

of the British Society of Animal Science
and the Agricultural Research Forum

2010

Advances in Animal Biosciences

This book is part of a series which is a companion to the journal ANIMAL



Kinetic of *in vitro* gas production of high fat sunflower meal treated with sodium hydroxide and or formaldehyde by rumen bacteria+protozoa

M Bojarpour¹, T Mohammadabadi¹, M Danesh Mesgaran², M Chaji¹

¹Department of Animal Science, Ramin Agriculture and Natural Resource University, Molasani, Ahvaz, Islamic Republic of Iran

²Excellence Center for Animal Science, Ferdowsi University of Mashhad, Mashhad, Islamic Republic of Iran

Email: t.mohammadabadi@gmail.com

Introduction Gas production technique is a useful procedure to assess digestible value of the ruminant feeds. Digestion of plant cell walls is carried out in the rumen by a complex of bacteria, fungi and protozoa and the degradability of cell walls of samples by both groups was higher each microbial alone that shows synergistic interaction between rumen microbial groups (Schofield, 2000). The feeding value of the sunflower meal depends on the oil extraction process, variety of sunflower and the proportion of the hulls removed during the extraction. High fat of sunflower meal may have negative effects on rumen protozoa and some of bacteria, so decrease digestibility. Formaldehyde decreases protein degradability and sodium hydroxide (NaOH) (Chen *et al.*, 2007) increase digestibility, these treatment may influence interaction between protozoa and bacteria. The objective of this study was to investigate the effect of high fat sunflower meal (SFM, 165 g fat/kg DM) as untreated or treated with formaldehyde and or sodium hydroxide on rumen bacteria and protozoa and interaction between them for degrading of SFM by the *in vitro* gas production method.

Material and methods The samples (five replicates) were: untreated SFM (USFM), NaOH treated SFM (40 g/kg DM, NSFM), formaldehyde treated SFM (30 g/kg DM, FSFM). About 500±10 mg of oven dried and milled sample (1.0 mm screen) was incubated with 30 ml buffered rumen (bacteria +protozoa) fluid (20 ml medium and 10 ml rumen bacteria +protozoa). To preparing bacteria +protozoa, rumen fluid was collected from two fistulated Holstein steers (400±12 Kg, body weight) fed twice daily a diet containing 5.72 kg lucerne hay and 3.08 kg concentrate mixture, then benomyle (500 ppm/ml medium) and metalaxyle (10 mg/ml medium) were added to rumen fluid and used in *in vitro* gas production technique. All samples were incubated in triplicate with three syringes containing only incubation medium or blank (three run of gas production) and gas production from the sample was corrected for the blank. Gas production was measured at 2, 4, 6, 8, 12, 24, 48, 72 and 96 h. Cumulative gas production data were fitted to the exponential equation $Y=B(1-e^{-Ct})$, where B is the gas production from the fermentable fraction (ml), C is the gas production rate constant for B , t is the incubation time (h) and Y is the gas produced at time t . *In vitro* digestibility of organic matter (OMD, g/kg OM) and metabolisable energy (ME, MJ/kg DM) of samples were calculated by the equation of Menke and Steingass (1988). Short chain fatty acid concentration (SCFA, µmol) was measured by the equation as proposed by Getachew *et al.* (1999). Data of gas production, ME, OMD, and SCFA were subjected to analysis as a completely randomized design using the General Linear Model (GLM) procedure of SAS (1990). Duncan's multiple range test was used to compare treatment means at $P < 0.01$.

Results *In vitro* gas production parameters, OMD, ME, and SCFA of the sunflower meal by rumen bacteria+protozoa are shown in Table 1. Gas production parameters of NaOH treated SFM were significantly higher than the other treatments ($P < 0.01$). NaOH resulted in increase OMD, ME and SCFA, but formaldehyde decreased them in compared with the other samples.

Table 1 *In vitro* gas production parameters, OMD, ME, and SCFA of high fat sunflower meal treated with formaldehyde and or sodium hydroxide by rumen bacteria+protozoa

	Treatments			s.e.d	P
	USFM	NSFM	FSFM		
B (ml)	174.3 ^b	186.2 ^a	138.9 ^c	0.5	0.01
C (ml/h)	0.016 ^b	0.022 ^a	0.012 ^c	0.001	0.01
OMD (g/kg OM)	171.9 ^b	189.5 ^a	166.7 ^c	0.2	0.01
ME (MJ/kg DM)	13.30 ^b	16.75 ^a	12.35 ^c	0.3	0.01
SCFA (µmol)	0.62 ^b	0.81 ^a	0.45 ^c	0.002	0.01

Conclusions It was concluded that *in vitro* gas production parameters, OMD, ME and SCFA of sunflower meal treated with sodium hydroxide by rumen bacteria+protozoa were improved in compared with the other samples, sodium hydroxide hydrolyses the ester linkages between lignin and the cell wall polysaccharides mainly hemicellulose (Chesson, 1981) and followed by significant improvements in organic matter digestibility (Nakashima and Orskove, 1989). Therefore using of sodium hydroxide for treatment of sunflower meal resulted in to improve fermentation by rumen bacteria and protozoa in compared with formaldehyde.

References

- Chen, X. L., Wang, J.K., Wu, Y.M., and Liu, J.X. 2007. *Animal Feed Science and Technology* 147, 1-14.
- Chesson, A. 1981. *Journal of the Science, Food and Agriculture*. 32, 745-58.
- Getachew, G., Makkar, H.P.S., and Becker, K. 1999. EAAP Satellite Symposium, 18-19 August, Wageningen, The Netherlands.
- Menke, K.H., and Steingass, H. 1988. *Animal Research Development*. 28, 7-55.
- Nakashima, Y., and Orskov, E. R. 1989. Rumen degradability of straw. 7. *Animal Production*. 48: 543-52
- Schofield, P., 2000. Gas production methods. In: D'Mello JPF, editor. *Farm animal metabolism and nutrition*. Wallingford, UK: CABI Publishing.

- 257 The effect of offering grass silage alone or in combination with legume:cereal wholecrop silage on methane emissions of Holstein steers
P C Kennedy, L E Dawson, D J Kilpatrick
- 258 The effect of electromagnetic water treatment on *in vitro* methane production
M O'Brien, P O'Kiely
- 259 Effect of legume and perennial ryegrass herbage on *in vitro* methane output using the total gas production technique
A Navarro-Villa, M O'Brien, S Lopez, T M Boland, P O'Kiely
- 260 *In vitro* methane output of perennial ryegrass produced under four grazing management regimes and sampled throughout the growing season
P Purcell, M O'Brien, T M Boland, M O'Donovan, P O'Kiely
- 261 The effect of sward maturity on the *in vitro* digestibility and methane production of sward components
C J Quinlan, M B Lynch, M O'Brien, A Navarro, T M Boland
- 262 Effect of sward maturity on the dry matter intake, enteric methane emission and milk solids production of pasture grazed dairy cows
M H Deighton, C M Wims, B M O'Loughin, E Lewis, M O'Donovan

FEED EVALUATIONS/TECHNIQUES

- 263 Effect of adding different levels of probiotic on *in vitro* gas production of noodle waste
M Besharati, A Taghizadeh, A Ansari
- 264 Effect of peppermint (*Mentha piperita*) essential oil on *in vitro* gas production parameters of lucerne hay and cottonseed hulls
E Jani, M Danesh Mesgaran, A R Vakili, A Soleimani, H Jahani-Azizabadi
- 265 *In vitro* gas production parameters of chickpea (*Cicer arietinum* L.) by-product
E Abdi Ghezeljeh, M Danesh Mesgaran
- 266 Use of *in situ* technique to evaluate three weed forages
M Kazemi, A M Tahmasbi, R Valizadeh, A R Vakili, M M Moheghi
- 267 Kinetic of *in vitro* gas production of high fat sunflower meal treated with sodium hydroxide and or formal dehyde by rumen bacteria+protozoa
M Bojarpour, T Mohammadabadi, M Danesh Mesgaran, M Chaji
- 268 The kinetic of *in vitro* gas production of tannic acid treated sunflower meal with or without polyethylene glycol
T Mohammadabadi, M Chaji, S Tabatabaei
- 269 Nitrogen fractionations, *in situ* ruminal degradation and post-ruminal crude protein disappearance of over heat and overheat-xylose processed guar meal
H Jahani-Azizabadi, M Danesh Mesgaran, A R Vakili, M Vatandoost, M Mojtahedi, E Abdi Ghezeljeh, A Hojjat Panah, A Fanaie-Nokar
- 270 *In vitro* first order dry matter disappearance kinetics of chemically and physically treated cottonseed hulls
A Famarzi Garmroodi, M Danesh Mesgaran, A R Vakili, A R Heravi Moussavi, A Tahmasbi, H Jahani-Azizabadi
- 271 Use of white rot fungi to improve the feed value of rice straw
J W Cone, J J P Baars, A S M Sonnenberg
- 272 Cultivation of oyster mushrooms (*Pleurotus* species) to improve the *in vitro* dry matter digestibility of wheat straw for feeding to ruminants
H Omed, A Avagyan, M Hale, J Gibbons
- 273 Evaluation of condensed tannin content of some native tanniniferous plants from semi-arid regions in Brazil
R C Lucas, A L Abdalla, M E Q Vieira, J D F Gomes, M R R S Peçanha, M T Lima, R Moura, B Berenchein, A S Morsy, Y A Soltan
- 274 Chemical composition and dry matter degradability coefficients of Fennel seed
M Kazemi, A M Tahmasbi, R Valizadeh, M Danesh Mesgaran, A A Naserian