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

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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				
	USFM	NSFM	FSFM	s.e.d	P
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

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https://doi.org/10.1017/S2040470010004103 Published online by Cambridge University Press