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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 Mohammadabadi2, 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 fistulat ed 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

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

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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The effect of electromagnetic water treatment on in vitro methane production
M O’Brien, P O’Kiely

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

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

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

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**

Effect of adding different levels of probiotic on in vitro gas production of noodle waste
M Besharati, A Taghizadeh, A Ansari

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

In vitro gas production parameters of chickpea (Cicer arietinum L.) by-product
E Abdi Ghezeljeh, M Danesh Mesgaran

Use of in situ technique to evaluate three weed forages
M Kazemi, A M Tahmasbi, R Valizadeh, A R Vakili, M M Moheghi

Kinetic of in vitro gas production of high fat sunflower meal treated with sodium hydroxide and or formaldehyde by rumen bacteria+protozoa
M Bojarpour, T Mohammadabadi, M Danesh Mesgaran, M Chaji

The kinetic of in vitro gas production of tannic acid treated sunflower meal with or without polyethylene glycol
T Mohammadabadi, M Chaji, S Tabatabaei

Nitrogen fractionations, in situ ruminal degradation and post-ruminal crude protein disappearance of overheat and overheat-xylose processed guar meal
H Jahani-Azizabadi, M Danesh Mesgaran, A R Vakili, M Vatandoost, M Mojtabaie, E Abdi Ghezeljeh, A Hojjat Panah, A Fanaie-Nokar

In vitro first order dry matter disappearance kinetics of chemically and physically treated cottonseed hulls
A Faramarzi Garmroodi, M Danesh Mesgaran, A R Vakili, A R Heravi Moussavi, A Tahmasbi, H Jahani-Azizabadi

Use of white rot fungi to improve the feed value of rice straw
J W Cone, J P Baars, A S M Sonnenberg

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

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 Berenheitin, A S Morsy, Y A Soltan

Chemical composition and dry matter degradability coefficients of Fennel seed
M Kazemi, A M Tahmasbi, R Valizadeh, M Danesh Mesgaran, A A Naserian