In vitro gas production parameters of chickpea (Cicer arietinum L.) by-product

E Abdi Ghezeljeh, M Danesh Mesgaran
Department of Animal Science Excellence Centre for Animal Science, Ferdowsi University of Mashhad, Mashhad, Islamic Republic of Iran
Email: E_abdi2005@yahoo.com

Introduction Chickpea (Cicer arietinum L.) is a legume seed, which is mostly used for human food. Approximately 7500 ton wastes of chickpea including pre-screening seeds and chickpea bran (known as chickpea by-product) are produced annually in North West Iran. The aim of the present study was to determine chemical composition and in vitro gas production parameters of chickpea by-product.

Material and methods Samples of chickpea by-product including pre-screening seeds and chickpea bran were collected from chickpea sorting factories located in North West Iran during September to December, 2008. Chemical composition including organic matter (OM), crude protein (CP), ether extract (EE) and crude fibre (CF) were determined using standard procedures (AOAC, 1995). Neutral detergent fibre (NDF) and acid detergent fibre (ADF) were determined using the method of Van Soest et al. (1991). Total extractable phenolic compounds (TPC) and total tannin (TT) were determined using procedures of Julkunen-Titto (1985) and Makkar (1992), respectively. Three fistulated Balochi sheep (49.5±2.5 kg) were used as rumen liquor donor for gas production technique. Rumen fluid was collected before the morning feeding and strained through 4 layers of cheesecloth into a CO2-filled flask. In vitro incubation of the samples was done using calibrated glass syringes followed the procedures of Menke and Steingass (1988). Approximately 200 mg of each sample was weighed into four replicate calibrated glass syringes of 100 ml. The syringes were pre-warmed at 39 °C before the injection of 30 ml rumen fluid-buffer mixture into each syringe followed by incubation in a water bath at 39 °C. Readings of gas production were recorded at 2, 4, 8, 12, 24, 36, 48, 72, and 96 h after incubation. Cumulative gas production data were fitted to a model of Y= b(1-e-ct); where: Y= potential of gas production at time t; b= gas produced from the soluble and insoluble fraction (ml); c= gas production constant rate (ml/h); t= incubation time (h). Data were statistically analyzed using SAS (1999) software.

Results Chemical composition of chickpea by-product is presented in Table 1. Results of the present study indicated the chemical composition, except OM, was significant different between the samples evaluated (P< 0.05). Gas production parameter and calculated amount of organic matter digestibility (OMD) and metabolizable energy (ME) are presented in Table 2. The amount of b and value calculated for OMD and ME of chickpea pre-screening were significantly higher than chickpea bran (P< 0.01). Gas production rate constant of chickpea bran was significantly higher than chickpea pre-screening (P< 0.01).

Table 1 Chemical composition of chickpea by-product (g/kg DM)

<table>
<thead>
<tr>
<th>Chickpea by-product</th>
<th>OM</th>
<th>CP</th>
<th>EE</th>
<th>CF</th>
<th>NDF</th>
<th>ADF</th>
<th>TN</th>
<th>TPC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chickpea pre-screening</td>
<td>940</td>
<td>279</td>
<td>78</td>
<td>72</td>
<td>351</td>
<td>96</td>
<td>1</td>
<td>3.4</td>
</tr>
<tr>
<td>Chickpea bran</td>
<td>927</td>
<td>44</td>
<td>87</td>
<td>178</td>
<td>323</td>
<td>224</td>
<td>6.5</td>
<td>7.5</td>
</tr>
<tr>
<td>s.e.d</td>
<td>6.2</td>
<td>5.4</td>
<td>1.4</td>
<td>2.4</td>
<td>6.6</td>
<td>10.1</td>
<td>0.55</td>
<td>0.75</td>
</tr>
<tr>
<td>P</td>
<td>&gt;0.05</td>
<td>&lt;0.01</td>
<td>&lt;0.01</td>
<td>&lt;0.01</td>
<td>&lt;0.01</td>
<td>&lt;0.01</td>
<td>&lt;0.01</td>
<td>&lt;0.01</td>
</tr>
</tbody>
</table>

Table 2 Gas production parameters, organic matter digestibility (OMD)* and metabolizable energy (ME)** content of chickpea by-product

<table>
<thead>
<tr>
<th>Item</th>
<th>Chickpea pre-screening</th>
<th>Chickpea bran</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>b (ml)</td>
<td>66.4±2.42</td>
<td>93.6±2.51</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>c (ml/h)</td>
<td>0.056±0.0052</td>
<td>0.024±0.0023</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>OMD (%)</td>
<td>59.1±0.42</td>
<td>42.1±1.5</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>ME (MJ/kg)</td>
<td>8.95±0.074</td>
<td>6.5±0.2</td>
<td>&lt;0.01</td>
</tr>
</tbody>
</table>

*OMD = 0.9991 Gas + 0.0595 CP + 0.0181 CA + 9
**ME = 0.157 Gas + 0.0084 CP + 0.022 EE – 0.0081 CA + 1.06

Conclusions Results obtained in the present study regarding the chemical composition of chickpea pre-screening confirmed the finding of Abdi and Danesh Mesgaran (2009). Values calculated for both ME and OMD of chickpea pre-screening were significantly higher than those of chickpea bran (P< 0.01), which might be due to difference in chemical composition and volume of gas production in the first 24 h. It was concluded that the by-products evaluated in the present experiment had a potential to use as suitable feed in ruminant rations. However, future feeding trials will be proposed to evaluate the effect of this by-product in ruminant production.

References
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

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 over heat and overheat-xylose processed guar meal
H Jahani-Azizabadi, M Danesh Mesgaran, A R Vakili, M Vatandoost, M Mojtaba, 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 tanniferous 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 Berenchtein, 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