A COMPARISON OF TWO EXCRETA COLLECTION TECHNIQUES (TRAY vs PLASTIC BAG) FOR AMINO ACIDS DIGESTIBILITY AND METABOLIZABLE ENERGY DETERMINATIONS OF RAPESEED MEALS IN ADULT COCKERELS

Zupritaz and M. Larbier

ABSTRACT

Two techniques of excreta collection (tray and plastic bag) were compared to measure true digestibility of protein (TDP), amino acids (TDAA) and true metabolizable energy (TME) of rapeseed meals, obtained from whole seed (WRSM) and dehulled seed (DRSM). Thirty-six intact ( Isa Brown) cockerels of 12 months old, were divided into two groups of 18 cockerels each. They were fasted for 24 hours and then force fed a moistened diet composed of 50% feed and 50% water. In the first group, trays were placed under cages for excreta collection, and in the second one, the plastic bags with harnesses, were attached to the birds immediately after force feeding. The two techniques of excreta collection (tray and plastic bag) had no significant effect on TDP, means of TDAA of 14 amino acids and TME of WRSM and of DRSM. However, true digestibility of cystine of WRSM and of DRSM was higher (P<.05) for plastic bag compared to the tray technique. True digestibility value of cystine of WRSM for tray and plastic bag techniques was 74.4 and 77.9%, respectively. Those of DRSM were 79.1 and 84.9%. Those results may be explained by the fact that there was a contamination of excreta with scales and feathers in trays collection. Therefore, the plastic bag technique appears to be more suitable and precise for determining the true digestibility of amino acids in feedstuffs.

(Key words: Excreta collection, Amino acids, Metabolizable energy, Digestibility, Rapeseed meals.)

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INTISARI

Dua teknik koleksi ekreeta (nampan dan kantong plastik) telah dibandingkan untuk mengukur nilai kecereman ril protein (TDP), asam-asam amino (TDAA) dan energi termabolisme ril (TME) dari bungkil rapeseed yang berasal dari whole seed (WSRSM) dan dehulled seed (DRSM). Tiga puluh empat ayam jantan dewasa umur 12 bulan, dibagi menjadi dua kelompok yang tiap kelompok ada 18 ekor. Setelah 24 jam dipukul, ayam dipisahkan dengan pakan yang lebih dicampur dengan 50% air (50% air dan 50% bahan pakan). Pada kelompok pertama, nampan diletekkan di bawah lantai untuk menangkap ekreeta dan kelompok kedua ekreeta ditampung dengan menggunakan kantong plastik yang diikatkan dengan tas bungkusan hammers pada ayam segera setelah dilidol. Kedua teknik koleksi ekreeta (nampan dan kantong plastik) tidak mempengaruhi perbedaan yang nyata untuk nilai TDP, asam-asam amino dan TME dari WSRSM dan DRSM. Sedangkan, untuk nilai kecereman ril asam amino sini dari WSRSM dan DRSM adalah lebih besar (P<0,05) untuk teknik kantong plastik bila dibandingkan dengan teknik yang mengguanakan nampan. Nilai kecereman ril asam amino sesuguhnya untuk WSRSM adalah 74,4% untuk teknik nampan dan 77,9% untuk teknik kantong plastik, sedangkan untuk DRSM adalah 79,1 bunsing 84,9%. Dari hasil penelitian ini dapat dijelaskan bahwa ada kontaminasi ekreeta dengan scs dan bulu pada pakan yang menggumpalkan nampan. Ini dapat disimpulkan bahwa teknik kantong plastik lebih baik dan lebih tepat untuk digunakan dalam penelitian pengukuran nilai kecereman, khususnya untuk nilai kecereman ril asam-asam amino dalam bawang pakan.

(Kata kunci: Koleksi ekreeta, Asam-asam amino, Energi termabolisme, Nilai kecerewan, Bungkil rapeseed.)

Introduction

In the total fecal collection method of Sibbald (1976) to determine the TME (True Metabolizable Energy) or TDAA (True Digestibility of Amino Acids) excreta were, initially, collected in a plastic tray which was placed under the cage. The disadvantage of this procedure is contamination of excreta with scales and feathers. As these contaminants are high in protein, the validity of this procedure may be questioned, specially in order to determine the true digestibility of amino acids. Sibbald (1983) used the human colostomy bags to birds to collect excreta, but this procedure was abandoned because there were problems of adhesion and of removing the bags of the area of the cloaca. A new technique of excreta collection was described by Almeida and Baptista (1984). Excreta were collected in a plastic bag tied to a padded metal ring held in place by a harness. This procedure has been developed by Sibbald (1986) to measure the true metabolizable energy and true digestibility of amino acids in poultry feedstuffs.

The objective of this study is to compare the two techniques above (trays vs plastic bag) for excreta collection on true digestibility of protein (TDP), amino acids (TDAA) and true metabolizable energy (TME) of rapeseed meals in adults cockerels.

Materials and Methods

Raw materials

Two rapeseed meals: whole seed (WSRSM) and dehulled seed (DRSM) were obtained from a local very low glucosinolate cultivar (Samoussi). They were processed by the pilot industrial technological plant of CETON (Centre Technique Interprofessionnel des Oléagineux Métropolitains, Paris, France) where they were solvent-extracted as a whole product or after dehulling. The technical procedures of dehulling and of oil extraction of the seed have been described by Basset et al. (1987).
Experimental procedure

Thirty six intact (ISA BROWN) cockerels of one year old were housed in individual wire-mesh metabolic cages with water ad libitum, and they received 16 h of artificial light per day. Birds were divided into two groups of 18 cockerels each. They were fasted for 24 hours and then force fed a moistened diet composed of 50% feed and 50% water. Two force feeding technique and equipment were similar to those described by Lenitre (1990). In the first group, trays were placed under cages for excreta collection. In the second group, the plastic bags with harnesses, were attached to the birds immediately after force fed. The procedure and equipment were similar to that of Almeida and Baptista (1984) (Figure 1). Excreta were collected daily during the subsequent 48 hours in the first group (tray technique), and only once collection during 48 hours for the second group (plastic bag technique). Excreta were then freeze-dried, weighed (after equilibration with atmospheric moisture) and ground to pass through a 1 mm screen. Endogenous losses of N, amino acids and energy were determined on fasted birds for 24 hours.

Chemical analysis

Samples of WRSM and DRSM were analysed for dry matter (DM), crude fibre (CF) and ash contents using methods recommended by the Association of Official Analytical Chemists (AOAC, 1980). Crude protein (CP) (N x 6.25) content was determined by Kjeldhal method (AFNOR, 1985). Water-insoluble cell walls (WICW) contents of WRSM and DRSM were determined by the method of Carrel and Brilouet (1989). The amino acids contents of WRSM, DRSM and excreta were determined in the same condition using an autoanalyser (BIOTRONIK, Amino acid Analyser LC.5001) after 24 hours of acid hydrolysis with 6 M aqueous HCl at 115°C. Methionine and cystine were determined on samples oxidised with performic acid by the method of Moore (1963). The method of Terpstra and de Hirst (1974) was used to separate folic nitrogen from uracil nitrogen for estimating protein digestibility. Samples of each meal and excreta, were analyzed for gross energy using an adiabatic oxygen bomb calorimeter. The TDP and TDAA calculations were based on the formulas of Mohamed et al. (1989) and Likuski and Dorell (1979) respectively. True metabolizable energy (TME) values were calculated as described by Sibbald (1979).

Statistical analysis

In the experiment, analysis of variance was carried out, and the comparison of means was done by Tukey's test. The calculations were performed using a SYSTAT software program (Wilkinson, 1989).

Results and Discussion

The results of chemical analysis of two rapped meals are presented in Table 1. Dehulling the seed before oil-extraction increased protein content (CP) from 40.1 to 46.6% in dry matter. This increase in protein content is due to the decrease of crude fibre (CF) or water-insoluble cell walls (WICW) content in rapped meals (Table 1). These results are in good agreement with the results obtained by several authors (Lenitre et al., 1987; Baulet et al., 1985). Lenitre (1987) reported that dehulling the seed before oil extraction can reduce the crude fibre content by up to 50%. However, dehulling has no effect on the ash and gross energy contents of rapped meal.

Amino acids composition of two rapped meals are shown in Table 2. Dehulling of seeds before oil-extraction increased amino acids concentration in the protein of meals, except for serine and lysine which decreased. These results are similar to most of previous studies (Sarwar et al., 1981; Picard and Darcy-Vrillon, 1985; Zaprizel et al., 1991) who found that the hull proteins were higher in lysine, serine, valine and threonine, than in dehulled ones.

Dehulled the seed improved the TDP, TDAA and TME of the rapped meal (Table 3). This results may be explained by the removal of hull fraction of rapped which are known to be less digestible than the dehulled fraction of the rapped. According to Finlayson (1974) the hull fractions of rapped are resistant to degradation in the
**TABLE 1. COMPOSITION OF THE TWO RAPESEED MEALS (DRY MATTER BASIS)**

<table>
<thead>
<tr>
<th></th>
<th>Rapeseed meal</th>
<th>SEM</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>WRSM</td>
<td>DRSM</td>
</tr>
<tr>
<td>Crude protein (%)</td>
<td>40.1</td>
<td>46.6</td>
</tr>
<tr>
<td>Crude fibre (%)</td>
<td>13.3</td>
<td>6.6</td>
</tr>
<tr>
<td>WICW² (%)</td>
<td>33.9</td>
<td>21.8</td>
</tr>
<tr>
<td>Ash (%)</td>
<td>9.4</td>
<td>10.0</td>
</tr>
<tr>
<td>Gross energy (Kcal/kg)</td>
<td>4605</td>
<td>4598</td>
</tr>
</tbody>
</table>

¹ WRSM = Rapeseed meal obtained from whole seed. DRSM = Rapeseed meal obtained from dehulled seed.
² WICW = Water-Insoluble Cell Walls.
³ SEM = Pool standard error of the mean.

**TABLE 2. AMINO ACIDS CONTENT OF TWO RAPESEED MEALS**

<table>
<thead>
<tr>
<th></th>
<th>WRSM (1)</th>
<th>DRSM (1)</th>
<th>WRSM (2)</th>
<th>DRSM (2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aspartic acid</td>
<td>3.72</td>
<td>8.05</td>
<td>4.21</td>
<td>9.03</td>
</tr>
<tr>
<td>Threonine</td>
<td>1.62</td>
<td>4.04</td>
<td>1.93</td>
<td>4.14</td>
</tr>
<tr>
<td>Serine</td>
<td>1.60</td>
<td>3.99</td>
<td>1.86</td>
<td>3.99</td>
</tr>
<tr>
<td>Glutamic acid</td>
<td>6.54</td>
<td>16.31</td>
<td>8.09</td>
<td>17.36</td>
</tr>
<tr>
<td>Glycine</td>
<td>2.00</td>
<td>4.99</td>
<td>2.56</td>
<td>5.49</td>
</tr>
<tr>
<td>Alanine</td>
<td>1.73</td>
<td>4.31</td>
<td>2.20</td>
<td>4.72</td>
</tr>
<tr>
<td>Valine</td>
<td>1.89</td>
<td>4.71</td>
<td>2.31</td>
<td>4.96</td>
</tr>
<tr>
<td>Isoleucine</td>
<td>1.51</td>
<td>3.82</td>
<td>1.84</td>
<td>3.95</td>
</tr>
<tr>
<td>Leucine</td>
<td>2.50</td>
<td>6.23</td>
<td>3.19</td>
<td>6.85</td>
</tr>
<tr>
<td>Tyrosine</td>
<td>1.08</td>
<td>2.69</td>
<td>1.32</td>
<td>2.33</td>
</tr>
<tr>
<td>Phenylalanine</td>
<td>1.49</td>
<td>3.72</td>
<td>1.91</td>
<td>4.10</td>
</tr>
<tr>
<td>Histidine</td>
<td>1.37</td>
<td>3.42</td>
<td>1.66</td>
<td>3.56</td>
</tr>
<tr>
<td>Lysine</td>
<td>2.19</td>
<td>5.46</td>
<td>2.49</td>
<td>5.34</td>
</tr>
<tr>
<td>Arginine</td>
<td>2.42</td>
<td>6.03</td>
<td>3.19</td>
<td>6.85</td>
</tr>
<tr>
<td>Methionine</td>
<td>.66</td>
<td>1.65</td>
<td>.86</td>
<td>1.85</td>
</tr>
<tr>
<td>Cystine</td>
<td>1.21</td>
<td>3.02</td>
<td>1.51</td>
<td>3.24</td>
</tr>
</tbody>
</table>

¹ WRSM = rapeseed meal obtained from whole seed. DRSM = rapeseed meal obtained from dehulled seed.
¹) = % of dry matter basis.
²) = % of crude protein.
TABLE 3. DIGESTIBILITY OF PROTEIN, AMINO ACIDS AND METABOLIZABLE ENERGY OF RAPESEED MEALS

<table>
<thead>
<tr>
<th></th>
<th>WRSM</th>
<th>DRSM</th>
<th>SEM*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Tray two collections 48 hr</td>
<td>Plastic bag one collection 48 hr</td>
<td>Tray two collection 48 hr</td>
</tr>
<tr>
<td>'7ME (Kcal/kg)</td>
<td>2098*</td>
<td>2539*</td>
<td>2561*</td>
</tr>
<tr>
<td>True digestibility of protein (%)</td>
<td>74.1*</td>
<td>74.4*</td>
<td>83.2*</td>
</tr>
<tr>
<td>True digestibility (%)</td>
<td>81.1*</td>
<td>83.4*</td>
<td>86.9*</td>
</tr>
</tbody>
</table>

Aspartic acid
Threonine
Serine
Glutamic acid
Alanine
Valine
Isoleucine
Leucine
Tyrosine
Phenylalanine
Lysine
Arginine
Cystine
Methionine
Mean digestibility of 14 amino acids

1 WRSM = Rapeseed meal obtained from whole meal
2 DRSM = Rapeseed meal obtained from detailed meal

Means carrying different superscript letters on the same line are significantly different (P < .05)

gastrintestinal tract.

In our study, two excreta collection techniques (tray and plastic bag) had no significant effect on TDP, TDAA of most of amino acids and TME of WRSM and of DRSM (Table 3). However, only true digestibility value of cystine in WRSM or in DRSM was higher (P < .05) for plastic bag than the tray technique. True digestibility value of cystine

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of WRSM for tray and plastic bag technique was 74.4 and 77.9%, respectively. Those of DRSM were 79.4 and 84.9%. This result may be explained by the fact that there was more contamination of excrata by insects and feathers in trays collection than the plastic bag technique.

Because the feathers protein content mainly of keratin with a high cystine content (Dugas et al., 1995), the contamination of excrata by feathers, in tray collection technique, can increase the cystine content in excrata, consequently the true digestibility value of cystine in tray collection technique was lower than plastic bag technique.

The results of this experiment suggest that the two feral collection techniques (tray and plastic bag) can be used to collect samples for TDP, TDAA and TME determinations of poultry experiments. The advantage of the plastic bag technique is that only one collection is needed during 48 hours of experimental periods. Moreover, for plastic bag technique, the true digestibility value of cystine may be more accurate than for the tray collection technique.

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References


Figure 1. A new device for collection of Poultry excreta