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

Zuprizal[1] and M. Larbier[2]

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%. These 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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[1] Faculty of Animal Husbandry, Gadjah Mada University, Yogyakarta 55281
[2] Station de Recherches Avicoles, Institut National de la Recherche Agronomique, 37380 Nouzilly, France

DUA TEKNIK KOLEKSI EKSRETA (NAMPAN *vs* KANTONG PLASTIK) UNTUK PENGUKURAN NILAI KECERNAAN RIIL ASAM-ASAM AMINO DAN ENERGI TERMETABOLISME DARI BUNGKIL *RAPESEED* PADA AYAM JANTAN DEWASA

INTISARI

Dua teknik koleksi eksreta (nampan dan kantong plastik) telah dibandingkan untuk mengukur nilai kecernaan riil protein (TDP), asam-asam amino (TDAA) dan energi termetabolisme riil (TME) dari bungkil *rapeseed* yang berasal dari *whole seed* (WRSM) dan *dehulled seed* (DRSM). Tiga puluh enam ayam jantan dewasa umur 12 bulan, dibagi menjadi dua kelompok yang tiap kelompok ada 18 ekor. Setelah 24 jam dipuasakan, ayam diloloh dengan pakan yang telah dicampur dengan 50% air (50% air dan 50% bahan pakan). Pada kelompok pertama, nampan diletakkan di bawah kandang untuk menampung eksreta dan kelompok kedua eksreta ditampung dengan menggunakan kantong plastik yang diikatkan dengan bantuan *harnesse* pada ayam segera setelah diloloh. Kedua teknik koleksi eksreta (nampan dan kantong plastik) tidak menunjukkan perbedaan yang nyata untuk nilai TDP, rata-rata nilai TDAA dari 14 asam amino dan TME dari WRSM dan DRSM. Sedangkan, untuk nilai kecernaan riil asam amino sistin dari WRSM dan DRSM adalah lebih besar ($P<0,05$) untuk teknik kantong plastik bila dibandingkan dengan teknik yang menggunakan nampan. Nilai kecernaan riil asam amino sistin untuk WRSM adalah 74,4% untuk teknik nampan dan 77,9% untuk teknik kantong plastik, sedangkan untuk DRSM adalah 79,1 banding 84,9%. Dari hasil penelitian ini dapat dijelaskan bahwa ada kontaminasi eksreta dengan *scales* dan bulu pada teknik yang menggunakan nampan. Ini dapat disimpulkan bahwa teknik kantong plastik lebih baik dan lebih tepat untuk digunakan dalam penelitian pengukuran nilai kecernaan, khususnya untuk nilai kecernaan riil asam-asam amino dalam bahan pakan.

(Kata kunci: Koleksi eksreta, Asam-asam amino, Energi termetabolisme, Nilai kecernaan, 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 (WRSM) and dehulled seed (DRSM) were obtained from a french very low glucosinolate cultivar (Samourai). They were processed by the pilot industrial technological plant of CETIOM (Centre Technique Interprofessionnel des Oléogineux Métropolitaines, 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 Baudet *et al.* (1987).

Experimental procedure

Thirty six intact (ISA BROWN) cockerels of one year old were housed in individual wiremesh metabolic cages with water *ad libitum*, and they received 16 h of artificial light per day. Birds were devided 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 Lessire (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 one 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 Carré and Brillouet (1989). The amino acids contents of WRSM, DRSM and excreta were determined in the same condition using an autoanalyzer (BIOTRONIK, Amino acid Analyser LC.5001) after 24 hours of acid hydrolysis with 6 M aqueous HCl at 115^0 C. Methionine and cystine were determined on samples oxidised with performic acid by the method of Moore (1963). The method of Terpstra and de Hart (1974) was used to separate fecal nitrogen from urinary 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 Dorelle (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, Leland, SYSTAT., 1987).

Results and Discussion

The results of chemical analysis of two rapeseed 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 rapeseed meals (Table 1). These results are in good agreement with the results obtained by several authors (Lessire *et al.*, 1987; Baudet *et al.*, 1988). Lessire (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 rapeseed meal.

Amino acids composition of two rapeseed 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; Zuprizal *et al.*, 1991) who found that the hull proetins were higher in lysine, serine, valine and threonine, than in dehulled ones.

Dehulling the seed improved the TDP, TDAA and TME of the rapeseed meal (Table 3). This results may be explained by the removal of hull fraction of rapeseed which are known to be less digestible than the dehulled fraction of the rapeseed. According to Finlayson (1974) the hull fractions of rapeseed are resistant to degradation in the

TABLE 1. COMPOSITION OF THE TWO RAPESEED MEALS (DRY MATTER BASIS)

	Rapeseed meals[1]		SEM[3]
	WRSM	DRSM	
Crude protein (%)	40.1	46.6	.21
Crude fibre (%)	13.3	6.6	.12
WICW[2] (%)	33.9	21.8	.22
Ash (%)	9.4	10.0	.71
Gross energy (Kcal/kg)	4605	4598	60

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

TABLE 2. AMINO ACIDS CONTENT OF TWO RAPESEED MEALS

	Rapeseed meal[1]			
	WRSM		DRSM	
	(1)	(2)	(1)	(2)
Aspartic acid	3.23	8.05	4.21	9.03
Threonine	1.62	4.04	1.93	4.14
Serine	1.60	3.99	1.86	3.99
Glutamic acid	6.54	16.31	8.09	17.36
Glycine	2.00	4.99	2.56	5.49
Alanine	1.73	4.31	2.20	4.72
Valine	1.89	4.71	2.31	4.96
Isoleucine	1.53	3.82	1.84	3.95
Leucine	2.50	6.23	3.19	6.85
Tyrosine	1.08	2.69	1.32	2.83
Phenylalanine	1.49	3.72	1.91	4.10
Histidine	1.37	3.42	1.66	3.56
Lysine	2.19	5.46	2.49	5.34
Arginine	2.42	6.03	3.19	6.85
Methionine	.66	1.65	.86	1.85
Cystine	1.21	3.02	1.51	3.24

[1] WRSM = rapeseed meal obtained from whole seed; DRSM = rapeseed meal obtained from dehulled seed
(1) = % of dry matter basis.
(2) = % of crude protein

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TABLE 3. DIGESTIBILITY OF PROTEIN, AMINO ACIDS AND METABOLIZABLE ENERGY OF RAPESEED MEALS

	Rapeseed meals[1]				
	WRSM		DRSM		SEM[2]
	Tray two collections /48 hr	Plastic bag one collection /48 hr	Tray two collection /48 hr	Plastic bag one collection /48 hr	
TME (Kcal/kg)	2066[a]	2098[a]	2539[b]	2561[b]	96
True digestibility of protein (%)	74.1[a]	74.4[a]	83.2[b]	83.7[b]	3.01
True digestibility (%)					
Aspartic acid	81.1[a]	83.4[a]	86.9[b]	88.3[b]	2.93
Threonine	76.4[a]	77.6[a]	83.2[b]	84.3[b]	2.01
Serine	78.1[a]	79.2[a]	85.3[b]	85.1[b]	2.13
Glutamic acid	86.7[a]	86.9[a]	90.5[a]	90.8[b]	1.99
Alanine	80.3[a]	80.2[a]	84.9[b]	84.2[b]	1.79
Valine	79.1[a]	80.1[a]	86.4[b]	86.1[b]	2.53
Isoleucine	80.5[a]	81.5[a]	87.1[b]	87.1[b]	2.36
Leucine	83.3[a]	83.8[a]	87.5[b]	87.2[b]	1 97
Tyrosine	78.1[a]	79.5[a]	86.1[b]	87.2[b]	2 43
Phenylalanine	82.5[a]	82.7[a]	88.2[b]	87.4[b]	1 74
Lysine	76.1[a]	77.5[a]	83.1[b]	84.1[b]	1.63
Arginine	81.9[a]	80.8[a]	81.2[a]	82.1[a]	1.91
Cystine	74.4[a]	77.9[b]	79.1[b]	84.9[c]	1 23
Methionine	86.7[a]	86.8[a]	90.1[b]	90.8[b]	1 34
Mean digestibility of 14 amino acids	81.4[a]	82.1[a]	86.4[b]	86.9b	1.99

[1] WRSM = Rapeseed meal obtained from whole seed
DRSM = Rapeseed meal obtained from dehulled seed

[2] Pooled standard error of the means
Means carrying different superscript letters on the same line are significantly different ($P < .05$)

gastrointestinal 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 were higher ($P < .05$) for plastic bag than the tray technique. True digestibility value of cystine

of WRSM for tray and plastic bag technique was 74.4 and 77.9%, respectively. Those of DRSM were 79.1 and 84.9%. This result may be explained by the fact that there was more contamination of excreta by scales and feathers in trays collection than the plastic bags technique.

Becuase the feathers protein consists mainly of keratin with a high cystine content (Degussa, 1990), the contamination of excreta by feathers, in tray collection technique, can increase the cystine content in excreta, 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 fecal collection techniques (tray and plastic bag) can be used in excreta collection 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 period. 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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