AN EXAMINATION OF THE SOURCE OF VARIATION BETWEEN THE FINDINGS OF DIFFERENT INVESTIGATORS FOR THE NUTRITIONAL VALUE OF RAPESEED MEAL

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Table 1: Nutrient composition of soybean and rapeseed meals

	NAS-NRC (1971)		RAPESEED ASSOC CANADA (1972)		
	Soybean	Rapeseed	Expeller	Pre-press	All solvent
Crude Protein (%)	50.9	37.1	36.0	36.6	36.5
Crude Fibre (%)	2.8	13.7	12.2	12.6	13.2
Crude Fat (%)	-	-	6.8	1.8	2.6
ME (N) (kcal/g)	2.43	2.20	-	- (1.76)	-

Rapeseed meal is used as a protein supplement for domestic animals and it is commonly compared with soybean meal. To establish the relative monetary worth of these two feeds it is necessary to know their relative nutritional value. There are well established criteria upon which to base comparisons of different feeds and very often the relative monetary worth of the feeds is calculated automatically using electronic computers.

There are many nutrients which can be defined for the purposes of these comparisons and the slide shows the 'principle proximate components': crude protein, fibre and fat, along with the nitrogen corrected matabolizable energy values of soybean and rapeseed. For practical reasons it is more usual to use mean values tabulated by different authorities rather than assaying each sample of feed. One commonly used tabulation is that produced by U.S. and Canadian nutritionists; the latest edition of Nutrient Requirements for Poultry (1971) shows that rapeseed meal has less protein, more crude fibre and a slightly lower ME(n) than soybean meal. The Rapeseed Association of Canada published a pamphlet in 1972 tabulating values for rapeseed meal extracted by three different processes. These authorities ascribed a value of only 1.76 kcal/g to the ME(n) of rapeseed meal.

The difference between the value of 2.20 and 1.76 kcal/g for the ME(n) of the same feedstuff clearly warrants further explanation.

Table 2: Published ME values for rapeseed meal samples

	Bayley et al. (1974)	Rao & Clandinin (1972)	March & Biely (1971)
Mean Value	1.68	1.47	1.34
Lowest Value	1.34	1.16	1.01
Highest Value	2.00	1.97	1.56

A series of 13 different rapeseed meal samples were prepared from B. napus and B. campestris cultivars of rapeseed by all three extraction processes, and the ME values of these meals were assayed in Guelph, Alberta and British Columbia with young chicks using the procedures in routine use in all three laboratories. Values ranging from 1.34 to 2.00 kcal/g were found in Guelph with lower values in Alberta and British Columbia indicating that not only the type of meal but the experimental routine used in the ME assay influenced the determined. value.

Table 3: Influence of basal diet (Rao & Clandinin 1970)

	Rapeseed meal	
	1	2
Type of diet		
Semi purified (Hill & Anderson)	1.32	1.17
Practical (Sibbald & Slinger)	1.70	1.61

There are two ways of feeding a test feedstuff to chickens: substituting it for corn-sugar in a semi purified diet (HILL and ANDERSON, 1958) or substituting it for the diet as a whole in a practical diet (SIBBALD and SLINGER, 1963). The latter method tended to produce higher results than the former for several feedstuffs, presumably because the coarser natural feeds passed through the digestive tract more slowly than the readily digested components of the semi-purified diet. However, RAO and CLANDININ (1970) showed the magnitude of this effect in chickens for rapeseed meal. Since the value in practical diets is of wider usefulness it is reasonable to conclude that this is the more correct of the two values.

Table 4: Influence of using total collection and indicator ratio on ME measurement

Method	ME	Confidence limits (p=0.05) Lower	Upper
Total Collection	3.11	3.09	3.13
Indicator Ratio	3.05	3.03	3.07

COATES (1973)

The relationship between the amount of feed consumed and the amount voided in the excreta can be established by weighing the feed consumed and the excreta produced over a 'collection period' of several days: total collection method. Alternatively, the change in the concentration of a nutritionally inert indicator can be used to establish this relationship: the indicator ratio method. COATES (1973) found that the total collection method gave a significantly higher ME value for a basal diet than the indicator ratio method. However, he found that the variation was less between the values found with the indicator ratio method. It is not possible to say which is the correct value.

Table 5: Influence of level of inclusion of RSM in ME assay diet

Level of inclusion (%)	Bayley et al. (1974) Practical	Rao & Clandinin (1970)	
		Practical	Semi Purified
10	1.73	1.84	1.63
20	(1.33)	1.68	1.53
30	1.73	1.59	1.00
40	1.73		
50	1.73		

It was suggested by RAO and CLANDININ (1970) that the measured ME of rapeseed meal declined as the level of rapeseed meal was increased in the assay diet, this decline was especially marked for the semi purified basal diet. However, in an experiment in which 10 to 50 % of the basal diet was replaced by rapeseed meal there was no effect of level of inclusion of the rapeseed meal on the measured ME value, with the exception of the low value observed for the 20 % level of substitution.

Table 6: Influence of age and time on diet on ME assays

Age at collection (days) *	Age introduced to assey diet (days)			
	7	11	18	25
	ME(n) of rapeseed meal (kcal/g)			
14-16	1.29	1.31	-	-
21-23	1.40	1.35	1.35	-
28-30	1.50	1.63	1.63	1.60

* Significant effect (p=0.05)

Classical ME 28 day old chicks 1.64 kcal/g
2 kg rooster 1.79 kcal/g

Similarly there have been reports that both the age of the chicks and the length of time for which the birds have been receiving the rapeseed containing diets influence the determined metabolizable energy value of the rapeseed meal. Chicks were introduced to a corn-soy diet in which 40 % of rapeseed meal had been substituted at 7, 11, 18 and 25 days of age, and balances of feed consumed and excreta produced carried out when the birds were 2, 3 and 4 weeks of age. The measured ME value of the rapeseed meal increased with the age of the bird, but the length of time for which the birds had received the rapeseed meal substituted diet had no influence on the ME value. However, a comparison of the classical (uncorrected) ME values of the rapeseed meal measured with the 4 week old chicks and mature roosters showed that only a small increase took place after the chicks reached 4 weeks of age.

Table 7: Type of meal and ME value (kcal/g)

Cultivar	Processing method		
	All solvent	Pre-press solvent	Expeller
B. napus	1.86	1.52	-
B. campestris	1.83	1.45	1.72
	1.66	1.34	2.00
		1.88	
		1.49	

Table 8: Type of meal and proximate composition protein (%)

Cultivar	Processing method		
	All solvent	Pre-press solvent	Expeller
B. napus	37.2	33.7	-
B. campestris	35.2	35.8	35.0
	34.7	36.0	35.8
		34.3	
		35.3	

ME(n) ∫ Crude protein $r^2 = 0.01$

Ten samples of rapeseed meal were compared using four week old chicks, and ME values ranging from 1.34 to 2.00 kcal/g were obtained. There was no immediately apparent relationship between the cultivar of the seed, or the method of processing and the ME value.

The protein level in the meals shows a relatively narrow range of variation from 33.7 to 37.2 and an attempt to relate ME with crude protein by regression analysis showed that less than 1 percent of the variation in ME was related to the protein content.

The crude fibre levels in the rapeseed meal samples ranged from 12.1 to 15.3, but only 2 % of the variation in ME(n) was accounted for by variation in crude fibre level (Table 9).

The ether extractable fat in the meals was influenced by the process used to remove the fat from the seeds: most fat being left by the expeller process and least by the most commonly used pre-press solvent procedure. Almost half of the variation in ME was accounted for by the level of fat in the meal (Table 10).

Since ME values merely represent an integration of the products of the gross energy values, the absorbabilities and the levels of the different energy yielding components of a feedstuff it should be possible to estimate the ME of a feedstuff from a knowledge of its chemical analysis. COATES (1973) was able to account for over 80 % of the variation in ME samples of

Table 9: Type of meal and proximate composition
Crude fibre (%)

Cultivar	Processing method		
	All solvent	Pre-press solvent	Ex-peller
B. napus	12.1	13.6	
B. campestris	14.9	14.1	13.3
	13.8	13.6	14.0
		15.3	
		13.7	

ME(n) $\int$ Crude fibre $r^2 = 0.02$

Table 10: Type of meal and proximate composition
Ether extract %

Cultivar	Processing method		
	All solvent	Pre-press solvent	Ex-peller
B. napus	3.4	1.6	
B. campestris	4.0	1.4	6.8
	4.8	1.5	7.6
		2.2	
		1.6	

ME(n) $\int$ Fat $r^2 = 0.46$

Table 11: Regression equations for ME(n) against analyses

Barley (COATES 1973)

ME(n) = 3.521 x 0.087 (fibre)
$r^2 = 0.83$

Wheat (COATES 1973)

ME(n) = 3.492 x 0.040 (protein) - 0.103 (fibre) - 0.081 (ash) - 0.113 (selenium)
$r^2 = 0.80$

Rapeseed meal

ME(n) = 1.449 + 0.065 (fat)
$r^2 = 0.46$

barley and wheat by variation in their analysis (Table 11). In the case of the rapeseed meal samples studied, only residual fat was related significantly to ME value and this accounted for only half of the observed variation in ME value of the rapeseed meal.

I suggest that once procedural differences between laboratories have been overcome, research should be concentrated on the establishment of the relationship between the energy supply capacity of rapeseed meal and its chemical composition. Since rapeseed meal varies so much it would be important to be able to characterize individual samples on the basis of chemical analyses.

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