

DIGESTIBILITY TRIALS WITH RABBITS FOR SOME FEEDING STUFFS

By

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The feeding values of berseem hay, wheat bran and barley grains were estimated by digestibility trials with rabbits being fed directly without a basal ration; the values for T.D.N. were 43.45, 61.63 and 71.10 per cent respectively, the corresponding starch values were 29.68, 57.90 and 67.51. Statistical analysis showed that there was insignificant difference between values for various collection periods of 3, 6 or 9 days, for both T.D.N. and S.V. % of berseem hay. The feeding value for hay of berseem (*Trifolium alexandrinum*) with rabbits was about 13% less than for the same hay lot with sheep.

Rabbit feeding still rely on the information obtained from sheep and other animals inspite the difference in their digestive system. The same situation for sheep is also reported with poultry since their digestibility data are not applicable for rabbits. Sandford (1957), claimed that different strains and even different rabbits within a strain at the same age do not vary greatly in their percentage digestibility of the same food. He also indicated, that the ability to digest fibre increases with the increasing age of the rabbit. Young animals can digest this material to a very limited extent, consequently their rations should be relatively low in fibre.

Mangold (1950), found, by using markers in the ration for rabbits that, in general, the food marker first appeared from 4 to 6 hours after feeding, though, the time varied with the different individuals, nervous condition and excretory habit. As a matter of fact most of the rabbits excreted 70% to 98% of the material within the first 2 days. The excretion was completed by the 4th or 5th day.

Voris *et al.* (1940), found that rabbits did not differ from other domestic animals in their ability to digest concentrates. Roughages are most likely digested as for other classes of livestock except the crude fibre which is poorly utilized. The present work was carried out to study the nutritive value for hay of Berseem (*Trifolium alexandrinum*), wheat bran and barley grains with digestion trials for rabbits.

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Material and Methods*Animals :*

Male adult Baladi Red rabbits (from 1 $\frac{1}{2}$ — 2 $\frac{1}{2}$ years old) were taken from Dokki Poultry Farm, Anim. Prod. Dept., Min. of Agric. Three to four parasite free rabbits were housed individually in metabolism cages.

Metabolism Cages :

The metabolism cage (18 $\frac{1}{2}$ " \times 1 " \times 18 $\frac{1}{4}$ ") was made from galvanised iron and wire mesh provided with a sliding tray its height of 1 $\frac{3}{4}$ " and two metal containers (10" \times 1" \times 2 $\frac{3}{4}$ ") used as a feeder and a drinker (Plate 1). These two containers could be adjusted at a suitable height for animals. The tray was provided with a wire mesh floor (64 holes per square inch) to allow the urine to pass through and keep the faeces on the wire floor. A small metal receiver (with $\frac{1}{2}$ inch height) was placed on the wire mesh floor below the feeding trough to collect the scattered food.

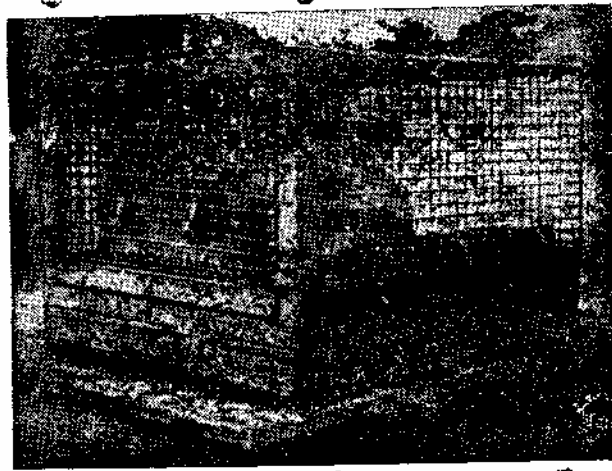


PLATE 1.—The experimental metabolism cage for rabbits

Rations :

The berseem hay, wheat bran and barley grains were fed separately and directly without a basal ration. The daily dry matter intake for all ingredients ranged from 60 to g. per rabbit.

Feeding :

Berseem hay was chopped to about 1—2 cm. and thoroughly mixed. The whole grains of barley were used. The average daily food consumption during the preliminary period was considered for the feeding trial. The daily

food allowances were weighed in paper bags at the beginning of the trial. The food was offered twice daily at 9 a.m. and 3 p.m. The food consumption was obtained by subtracting the residue from offered food.

Collection of faeces :

The 6 days preliminary period was followed by 9 days collection period. With hay only, two sub-periods were also tried (i.e. periods 1 and 2), period 1 included the first three days and period 2 included the first six days of the collection period.

Quantitative collection of faeces started 24 hours after offering the daily food, using aluminum dishes (20 × 10 × 3.5 cm.). Daily faeces were dried at 60 °C for 8 hours using a forced draught oven, then bulked, finely ground and stored in a screw top glass jars.

Analytical methods :

The conventional methods of the A.O.A.C. (1960), were followed using triplicate samples for analytical determinations.

Results and Discussion

1.—Berseem hay :

The proximate analysis of the Berseem hay are, moisture 7.55%, crude protein 16.68%, ether extract 2.74%, crude fibre 21.66%, N-free extract (N.F.E.) 35.61% and ash 14.76%.

The average percentage digestibility values, table 1, were 56.0 for dry matter, 53.2 for organic matter, 63.4 for crude protein, 62.4 for ether extract, 28.6 for crude fibre and 62.4 for N.F.E.

The present data are in good agreement with those obtained by Voris *et al* (1940, table 1), with rabbits for dry matter, crude protein, ether extract and N.F.E. The results obtained by Khafagi (1967, table 1), with Ossimi sheep on the same lot of hay, showed higher values, for dry matter, organic matter, crude protein and N.F.E. than those with rabbits in the present data. However, the percentage digestibility of ether extract was higher for rabbits than for sheep. Proto (1963), indicated that sheep digested all nutrients, but ether extract, better than did rabbits with lucerne hay and Egyptian clover (berseem). Digestibility of ether-extract with ruminants is usually lower than should be, because of the possible inclusion of faecal ether-extract of fatty acids coming as end-products from microbial breakdown of carbohydrates (cited by Abou-Rya, 1967).

The digestibility percentage of crude fibre with rabbits was about half that obtained with sheep.

TABLE 1.—PERCENTAGE DIGESTIBILITY OF NUTRIENTS AND FEEDING VALUE FOR BERSEEM HAY, WHEAT BRAN AND BARLEY GRAINS FOR THE EXPERIMENTAL RABBITS AND OTHER SPECIES

Ingredients and species	Authors	Percentage digestibility							Feeding value	
		Dry matter %	Organic matter %	Crude protein %	Ether extract %	Crude fibre %	N-free extract %	S.V. %	T.D.N. %	
Berseem hay:	Present study	59.0	53.2	63.4	62.4	28.6	62.4	29.68	31.14 †	
		±1.0	±1.3	±1.0	±2.6	±2.7	±1.4		43.45	
Rabbits*	Voris et al. (1940)	52.8	—	62.8	61.8	19.7	67.2	28.60	43.93	
		60.8	61.8	86.1	52.5	54.8	65.2	34.07	49.94	
Wheat bran:	Present study	65.0	66.5	77.3	69.3	21.7	70.0	57.90	61.63	
		±0.8	±0.8	±1.8	±1.3	±0.8	±0.6		4.24 †	
Rabbits**	Voris et al. (1940)	62.6	—	83.0	77.2	24.3	65.3	44.04	56.97	
		—	—	77.1	85.4	61.9	79.8	63.73	70.74	
Sheep**	Different authors†	—	—	76.0	58.0	23.0	69.0	44.34	57.50	
		—	—	65.4	68.6	1.0	33.2	31.95	35.46	
Pigs**	Schneider (1947)	34.4	36.7	—	—	—	—	—	—	
		—	—	—	—	—	—	—	—	
Poultry**	Minis. Agric. (1968)	—	—	—	—	—	—	—	—	
		—	—	—	—	—	—	—	—	
Barley grains:	Present study	76.1	77.2	56.6	82.1	32.0	84.7	67.51	15.94 †	
		±2.0	±1.9	±5.3	±2.2	±5.1	±1.3		71.10	
Rabbits	Voris et al. (1940)	82.0	—	84.8	106.2	12.5	89.3	67.94	70.76	
		—	—	79.9	77.8	70.5	92.0	75.59	78.25	
Sheep**	Different authors†	—	—	77.0	44.0	11.0	89.0	68.95	69.90	
		—	—	72.8	50.1	1.1	70.9	52.90	55.22	
Pigs*	Schneider (1947)	—	—	—	—	—	—	—	—	
		—	—	—	—	—	—	—	—	
Poultry	Minis. Agric. (1968)	61.1	64.4	—	—	—	—	—	—	
		—	—	—	—	—	—	—	—	

* Direct feeding (test ingredients only).

** Indirect feeding (test ingredients combined with a basal diet).

† Ghoneim (1955), Abou Hussein (1953) and Bull. No. 3/1968, Minis. Agric., U.A.R.

‡ Values for nutritive ration.

The feeding value of Berseem hay in the present study, table 1, was 43.45%, for total digestible nutrients (T.D.N.), and 29.68% for starch value (S.V.), which was similar to a great extent to that obtained by Voris *et al.* (1940).

The digestible crude protein was 10.75%. The present data of feeding value was 13% lower than that obtained with sheep on the same hay lot (table 1), when directly fed in both species.

Wheat bran :

The proximate analysis of wheat bran was 15.33% for crude protein, 3.17% for ether extract, 8.63% for crude fibre, 61.40% for N-free extract and 5.65% for ash.

The average percentage digestibility values, (table 1), were 65.0 for dry matter, 66.5 for organic matter, 77.3 for crude protein, 69.3 for ether extract, 21.7 for crude fibre and 70.0 for N.F.E. The results obtained by Voris *et al.* 1940, (table 1) with rabbits indirectly fed, showing fair agreement with the present data.

The average percentage digestibility values of fine wheat bran indirectly fed with sheep, obtained by different authors, table 1, were variable than those with rabbits ; where the digestibility of crude fibre with rabbits being about one third of that with sheep. While the digestibility of the other nutrients were markedly decreased with rabbits, except for crude protein which was similar in both species.

The percentage feeding values of wheat bran, table 1, were found to be 61.63 T.D.N. and 57.90 S.V., which slightly higher than that obtained by Voris *et al.* (1940), indirectly fed with rabbits. In a comparison between the feeding value of wheat bran in the present data and that for the other species (indirectly fed), (table 1) ; it was found that with rabbits, the value was similar to a certain extent with pigs, and intermediate for sheep and poultry.

Barley grains :

The proximate analysis of barley grains was 7.34% for crude protein, 2.33% for ether extract, 8.44% for crude fibre, 69.59% for N-free extract and 2.70% for ash.

The average percentage digestibility values, table 1, were 76.1 for dry matter, 77.2 for organic matter, 56.6 for crude protein, 82.1 for ether extract, 32.0 for crude fibre and 84.7 for N.F.E. The percentage digestibility of crude fibre was two and half folds that obtained by Voris *et al.* (1940), table 1. The marked difference for crude fibre and the other differences for other nutrients might be attributed to the associative effect of basal ration (alfalfa hay) used by the previous authors.

The average percentage digestibility values of barley grains indirectly fed with sheep, obtained by different authors, (table 1), were noticeably variable than those in the present data. It could be seen that the percentage digestibility value of crude fibre with rabbits in the present data was about half that with sheep. While the digestibility of crude protein and N.F.E. were markedly lower than with sheep. The digestibility of ether extract was slightly lower with rabbits than with sheep. Such discrepancy might be due to species differences and/or the associative effect with sheep using hay as a basal ration.

In a comparison between the percentage digestibility values for both rabbits in the present data and pigs (Schneider, 1947), it could be seen from table 1 that rabbits digested ether extract and crude fibre to power respectively of about twice and thrice that for pigs.

The percentage feeding value of barley grains, table 1, were found to be 71.10 T.D.N. and 67.51 S.V., which were similar to those obtained by Voris *et al.* (1940), with rabbits which were fed barley on grains indirectly, also, similar to those with pigs, directly fed, obtained by Schneider (1947). From the data in table 1, it could be seen also that the feeding value of barley grains with rabbits was intermediate between sheep and poultry.

However, when the feeding value for S.V. calculated by using Schurch's factors for rabbits (Schurch 1946, cited by Abou-Raya, 1967) ; for digestible nutrients, protein = 0.85, carbohydrates or fibre = 1 and ether-extract = 2.24, it was 29.28 for berseem hay, 47.27 for wheat bran and 67.37 for barley grains. These values being similar to those used by Kellner's factors with sheep.

Collection period in the digestibility trial for berseem hay :

The digestibility trial was carried out on berseem hay at different collection periods as follows :

1. Period I is from 1 to 3 days-collection.
2. Period II is from 1 to 6 days-collection.
3. Period III is from 1 to 9 days-collection.

The results of the percentage digestibility, digestible nutrients and feeding value for the three collection periods are presented in table 2.

The average percentage digestibility of the different nutrients for periods II and III were nearly similar, while the values for all nutrients (except for ether extract) of period I was slightly higher than for the other two periods. The differences between digestibility values for different nutrients at the different periods, within the individual rabbits were relatively small as indicated by the coefficient of variation (C. %, table 2).

TABLE 2.—PERCENTAGE DIGESTIBILITY, DIGESTIBLE NUTRIENTS AND FEEDING VALUE OF BERSEEM HAY AT DIFFERENT COLLECTION PERIODS.

Item	Period I (1—3 days)		Period II (1—6 days)		Period III (1—9 days)	
	Digestibility %	Digst. nut. %	Digestibility %	Digst. nut. %	Digestibility %	Digst. nut. %
Dry matter C.*%	58.7±1.1 3.19	54.25	55.3±1.0 3.27	51.09	56.0±1.0 3.11	51.73
Organic matter C.%	56.4±1.1 3.45	43.79	52.5±1.2 3.89	40.75	53.2±1.3 4.16	41.32
Crude protein C.%	68.6±0.9 2.29	11.45	63.5±1.9 5.05	10.59	63.4±1.0 2.79	10.57
Etyer extract C. %	58.2±0.7 2.20	1.59	62.9±1.3 3.69	1.73	62.4±2.6 7.20	1.71
Crude fibre C. %	34.4±1.4 6.89	7.45	26.7±2.4 15.39	5.79	28.6±2.7 16.39	6.20
N-free extract C.%	63.6±1.1 3.09	23.30	61.9±1.5 4.10	22.64	62.4±1.4 3.79	22.83
<i>Feeding value :</i>						
T.D.N. %	45.78		42.91		43.45	
S.V. %	31.99		29.13		29.68	
Nutritive ratio .	1 : 3.02		1 : 3.08		1 : 3.14	

* C. % = Coefficient of variation.

The values of coefficient of variation were not exceeding 3.27% for dry matter, 4.16% for organic matter, 5.05 for crude protein, 7.20% for ether extract and 4.10% for N-free extract. In the case of fibre, the coefficient of variation was relatively high in both periods being 15.39% for period II and 16.39% for period III, while it was relatively low (6.89%) in period I. Such high variation between the individual rabbits with fibre digestibility appeared to be a normal feature in digestion trial with nutrients of low digestibility.

Proto, V. (1964), by using hay in digestion trial with rabbits (8 days for collection period) found that the variability between animals were 6.4 for organic matter, 4.3 for crude protein, 45.1 for ether extract, 25.0 for crude fibre and 7.2% for N-free extract. The variability values for ether extract and crude fibre were higher than that obtained in the present study.

Statistical analysis for 'F' test showed that no significant difference ($P = 0.05$) was noted for the percentage digestibility between each period for dry matter, organic matter, ether extract, crude fibre and N-free extract. While there was a significant difference ($P = 0.05$) in percentage digestibility of crude protein between period I and the other two periods.

The least significant difference (L.S.D.) values for the percentage digestibility, were 3.75 for dry matter, 4.13 for organic matter, 4.59 for crude protein, 7.70 for crude fibre, 6.02 for ether extract and 4.61 for N-free extract. These results indicated that 3-day collection period produced practically the same digestibility values with different nutrients as well as the 9-day collection period. This would reduce time and labour in conducting digestibility trials with rabbits. In respect to species difference, similarly, Ismail *et al.* (1963), with poultry, found that three days collection-period would give the same results as with a lengthy period of 9 days. In addition, Abou-El-Hassan, *et al.* (1966), with sheep in a digestion trial, using berseem hay alone (the whole collection period of 12 days was divided into 3 successive sub-periods of 4 days each), found that it appeared permissible in practice to shorten the collection period with similar feeds down to 4 days.

Incidentally, the feeding value for T.D.N. and S.V. for berseem hay were of the same trend as that for the percentage digestibility of nutrients.

It could be concluded that these data may suggest that mean feeding values for the 3-day collection period, were practically similar for the lengthy period of 9 days.

Since percentage digestibility of nutrients differed for rabbits than for poultry and sheep, further studies are warranted to investigate the feeding stuffs which are commonly used for rabbits.

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تجارب هضم على الأرناب لبعض مواد العلف

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الملخص

اجريت تجارب هضم على الأرناب لتقدير القيمة الغذائية لدريس البرسيم المصرى ونخالة القمح وحبوب الشعير وذلك باستخدام طريقة التنفيذية المباشرة أى بدون استخدام العليقة الأساسية . وكانت القيمة الغذائية للمركبات المهضومة الكلية هى ٤٣ر٤٥ ، ٦١ر٦٣ ، ٧١ر١٠٪ على التوالي . وقيمة معادل النشا وبنفس الترتيب كانت ٢٩ر٦٨ ، ٥٧ر٩٠ ، ٦٧ر٥١٪ ولم يظهر التحليل الاحصائى أى فرق معنوى فى قيم كل من المركبات المهضومة الكلية أو معادل النشا لدريس البرسيم المصرى بين الفترات القصيرة من الدور الرئيسى وهى ٣ ، ٦ أيام وبين الدور الرئيسى وهو ٩ أيام . وقد كانت القيمة الغذائية لدريس البرسيم المصرى بالنسبة للأرناب أقل بحوالى ١٣٪ عن مثيلتها فى الأغنام باستخدام نفس المصدر من الدريس .

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