DIGESTIBILITY TRIALS WITH EGYPTIAN POULTRY TO STUDY THE FEEDING VALUE OF SOME FEEDING-STUFFS

II.—A Study with Barley Grains, Sorghum Grains and A Rice Starch By-Product.

By

A.K. ABOU-RAYA[1], M.A. RAAFAT[2], A.A. ABOUL-SEOUD[3] AND M.F. ISMAIL[4]

SUMMARY

An extension of the previous work was follwed to determine the feeding value of barley grains, sorghum grains and a rice starch by-product with poultry in digestion trials using Fayoumi cocks. Four to six birds were used in each trial for 5 to 7 days preliminary period and 5 days collection period. The digestion coefficients with barley were 73.05 for protein, 49.93 for fat, 1.03 for crude fibre and 70.84% with N.F.E. (soluble carbohydrates). The corresponding values were 85.71, 49.70, 18.02 and 79.68 with sorghum and 76.66, 64.58, 14.18 and 83.09 with rice starch by-product. The calculated total digestible nutrients, T.D.N., were 55.18, 64.64 and 66.92% for barely, sorghum and the by-product respectively with a corresponding Kellner starch value of 52.57, 62.09 and 64.12%. Results were in harmony with those published with similar foods with poultry and much lower than those published with sheep. Digestion of crude fibre was the lowest and up to 28.1% digestion coefficient was found with sorghum with an individual bird. The most suitable feeding standard was found to be the total digestible nutrients, and Fingerling starch value, both systems give practically the same numerical value. The metabolizable energy calculated from digestible nutrients after Titus were practically the same as those calculated from Fingerling starch value considering that 4077 calories metabolizable energy are equivalent to one kilogram starch value as he found with pigs.

INTRODUCTION

There is a gap in our knowledge about the feeding value and digestion coefficients for the common feeding sutffs fed to poultry. In a previous paper by the authors (11), the importance of metabolism trials with poultry to assess directly the feeding value was indicated. The physiology of digestion in poultry differes greatly from that of ruminant animals particulary sheep which were extensively used in Egypt for determining the feeding value (7,9).

(1) Assistant professor, Animal prod. Dept. (Nuttition), Fac. of Agric. Cairo University.

(2) Professor of Animal Nutrition, Faculty of Agriculture, Cairo University.

(3) Direcror, Poultry Nutrition Sec. Animal Prod. Dept. Ministry of Agric.

(4) Research Worker, Poultry Nutrition Sec. Animal Prod Dept. Minis. of Agric.

The results in the previous work (11) indicated the faulty picture given from data taken from digestibility trials with sheep and used for poultry feeding. With maize grains, it was found that the crude fibre was almost indigested and that the digestion coefficient of the soluble carbohydrates, the major nutrient, was lower than comparative figure with sheep. The caluclated total digestible nutrients (T.D.N.) figure with poultry was 70.07 (70.55 starch value, S.V.) being ca. 14% lower than the published data in Egypt with sheep (7,9). The difference was much greater with fine wheat bran and maize gluten feed ; their feeding value obtained with poultry was ca. half that obtained with sheep.

Following similar lines, further study was made with barley grains, sorghum grains, and a rice starch by-product. Digestible crude fibre was counted in feeding value according to the widely known concept confirmed by Titus, 1961 (12). He explained the faulty assumption of Fraps (4) who excluded digestible crude fibre in his calculation. In this respect Titus (12 p.245) mentioned that the crude fibre could be digested up to 10% or more in single rations and up to 40% or more in mixed feeds. This author indicated clearly the danger and limitation of " the productive energy system " used by Fraps. It is difficult to obtain, relying on questionable assumption and algebraic equations. Moreover, the productive energy differs according to the type of prodcution. He was in favour of the T.D.N system as well as the metabolizable energy produced from the total digestible nutrients rather than net energy for production

It seems from this review that some debateable subjects are still concerning the most suitable system for recording the feeding value for poultry. For completion, a comparative study was also presented in this work to choose the suitable feeding standard for poultry rations.

EXPERIMENTAL AND METHODS

Birds

Adult Fayoumi cocks of 12 months were taken from the Poultry Farm of the Animal Production Dept. Ministry of Agric. at Dokki. They were housed in individual metabolic cages. Four birds were used with barley grains, four with sorghum grains (*Sorghum vulgare var.*durra). and six with rice starch by-product.

Ration

Food was offered coarsely ground; the daily ration was kept in paper bags for each bird.

Metabolic cages

Metabolic cages were made from metalic wires (60×50×70 cm.) provided with a metalic zinc drawer (60×50×10 cm.) for faecal collection and with two containers (30×10×10 cm.) which could be fixed at a suitable adjustable height for keeping water and food. A small (drawer 50×20×3 cm.) was inserted in the collection drawer below the feeding container to collect any scattered food to collect any scattered food.

Preliminary and collection period

Birds were kept off food 18 hours before the preliminary period which continued for 5 to 7 days when food consumption was adjusted to minimize residual food in the collection period. Faecal collection started 24 hours after offering the food at 9.0 a.m. Droppings for each bird were collected quantitatively at the same time into an aluminium dish with the aid of a spatula and a suitable brush. The droppings were dried at 80°C, ground and preserved in screw capped bottles, then a composite sample was prepared from 5 daily samples of the collection period.

During the change of food, birds were kept in similar cages with their wings cross-wise to prevent then from voiding any droppings.

Food was offered directly without any basal ration The daily dry matter consumption varied between 76 and 89 grams with barley, between 61 and 87 with sorghum and betwen 37 and 87 grams with rice starch by-product, the average being 85, 76 and 61 grams respectively.

Analytical Methods

For summative analysis of food and faeces the ordinary official methods of analysis are used (2) for determining moisture, ash, protein, crude fat and ether extract. The nitrogen free extractives (soluble carbohydrates) were obtained by difference and the factor 6.25 was used for crude protein calculation.

Faecal nitrogen was determined directly in the droppings after dissolving uric acid by oxidation to allantion. This procedure was used by Bolton, 1957 (3) who indicated that analytical error is introduced if faecal nitrogen was determined indirectly. This is done by subtracting both ammonia and uric acid N from total nitrogen of the droppings as used by Moon and Armstrong (10). Some details of the procedure were taken by personal communication with Bolton via Mr. F.E. Abdel-Salam* to whom the authors are thankful.

* Member of the Animal Prod. Dept. (Poultry nutrition Sec.) Ministry of Agric, doing research now at Kings College, U.K.

Recording the feeding value

The total digestible nutrients were calculated in the ordinary manner considering 1 unit digestible fat to equal 2.25 units of digestible protein, nitrogen free extractives or crude fibre. Units of starch value were calculated from digestible nutrients following kellner's system (8) as used by Ghoneim (6) giving digestible crude protein the same feeding value as digestible true protein. The convertion factors used were 0.94, 2.12 and 1 for each unit of digestible protein, fat and carbohydrates (crude fibre + N.F.E.) respectively. A crude fibre deduction of 0.3 S.V. per unit crude fibre in the food was taken to convert the apparent starch value to the true starch value as used by Ghoneim (6) in grains and cakes instead of Kellner's value numbers.

Fingerling's starch value

For comparative study of different feeding standards, the starch value was calculated in the same manner as above but using the convertion factors found by Fingerling (6) for pigs being 1.05, 2.48 and 1 for each unit of digestible protein, fat and carbohydrates respectively. This seemed more logical as pigs are monostomachic animals and omnivorous being nearer to poultry in their physiology of digestion than ruminants.

Metabolizable energy from digestible nutrients

This was calculated from the energy equivalents reported by Titus 1961 (12 p. 254) per gram of digestible nutrients. They are 3.84 calories for protein, 9.33 for ether extract from grains and other seeds, 4.2 for N.F.E. from grains and 2.1 for crude fibre. It was calculated per 100 grams of the food.

Metabolizable energy from starch value

This was calculated from kellner's starch value considering that 3.761 calories metabolizable energy are produced from 1 gram starch value (as he obtained with sheep) and also that 4.077 calories metabolizable energy are produced from 1 gram starch value as found with Fingerling with pigs. It was then calculated from Fingerling's starch value using his metabolizable energy figure of 4.077. His figure appeared to be more applicable with poultry.

For convenience, the previous digestibility data in the previous paper (11) with maize grains, maize gluten feed and fine wheat bran were applied in the comparative study of the feeding standards for poultry.

RESULTS AND DISCUSSION

Composition, digestion coefficients and feeding value of barley grains

The composition of barley grains as fed (Table 1) was within the published data for barley in Egypt for all nutrients (7,9) but the barley abroad fed to poultry contained distinctly higher protein content being 11 by Titus (12) and 13.2% by Fraps (4) against 6.98% here. Their barley seemed also to contain slightly lower crude fibre and slightly higher ether extract.

The average percentage digestion coefficients with 4 cocks of Fayoumi breed (Table 2) were found to be 64.44 ±1.32 for organic matter, 73.05 ± 0.55 for protein, 49.93 ± 3.14 for ether extract, —1.03 ± 1.09 for crude fibre and 70.84 ± 1.49 for N.F.E. The agreement between quatriple cocks was satisfactory with different nutrients except with ether extract as the range of digestion coefficients was wide. This is usually not avoidable with replicates in digestion trials with minor nutrients.

Protein coefficient was the same as recorded by Titus (74%) and Fraps (73%), but those for organic matter, ether extract and N.F.E. were less by 10 degrees of percentage or more. Crude fibre was practically indigested having very minute negative and positive digestion, but Titus recorded 9% digestion for barley.

It seems that the relative proportion of barley nutrients affects its digestion coefficients, perhaps the higher protein content in barley reported by Titus and Fraps is responsible for raising the digestion coefficient of the other nutrients.

The reported digestion coefficients for barley nutrients in Egypt (7,9) when fed indirectly to sheep (using hay as basal ration) were 76-80 for protein, 75-80 for fat, 44-91 for crude fibre and 91-92% for N.F.E. being distinctly higher than the obtained data with poultry abroad or with Fayoumi cocks, particularly with crude fibre and N.F.E. This indicates clearly the wide differences between ruminants and poultry in their ability to digest concentrated foods. The basal ration used with ruminants has also an associative effect which might apparently increase the digestion coefficients of the tested concentrated ration.

As a result of the average coefficients obtained with barley, its feeding value was lower than recorded figure with Titus for T.D.N. being 55.18 against 67. The corresponding starch value, 52.57, was also distinctly lower than reported figures obtained by sheep in Egypt (74 to 76 S.V. with a T.D.N. value of 76 to 79), (9,7). Therefore the feeding value of Egyptian barley with poultry was 30% less than with sheep. This indicates the importance of assessing the feeding value for poultry rations using the birds in digestion trials.

The composition, digestion coefficients and feeding value of sorghum grains

The composition of sorghum grains (Table 1) was very approximately within the range published by other sources in Egypt (7,9) but the sample here contained 6.59% crude fibre which is higher than published range (2.5 - 3.4%) ; the soluble carbohydrates were also approaching the lower limit of the range being 67.54 (against 71.0 to 84.2%) When compared with a sorghum grain (Kafir) published by Titus and Fraps, the sample here contained less protein content and distinctly higher crude fibre. The sorghum sample also contains higher protein content and lower crude fibre than the barley sample.

Regarding the average digestion coefficients (Table 2) they were 75.54 ± 2.47, 85.71 ± 1.27, 49.70 ± 2.74, 18.02 ± 5.23 and 79.68 ± 2.26 for organic matter, protein, fat, crude fibre and soluble carbohydrates. The range was satisfactory within normal variations of individuals in digestion trials with all the nutrients except with crude fibre which has the lowest coefficients. It has been illustrated that wide variations among individuals occur with nutrients of low digestion from a study of the mathematical relations invloved in digestion trials (1). This may be also due to physiological differences among cocks in dealing with the curde fibre in the digestive tract. Here the crude fibre was digested to an appreciable extent up to 28.13%. This substantiated Titus (12) view that digestible crude fibre should not be ignored in assessing the feeding value for poultry feeds. The nature of the crude fibre appears to vary according to the plant material; with barley no digestion occurred while with sorghum it was noticeably digested.

Comparison with Titus data with sorghum (Kafir) using poultry, the digestion coefficients with protein (82%) and crude fibre (15%) were practically the same, but they were higher with fat (80%) and N.F.E (93%). The digestion coefficients with sorghum in Egypt using sheep ranged between 46 to 63 for protein, 49 to 100 with fat, up to 23% with crude fibre and between 82 and 93 with N.F.E., being lower in protein and higher in N.F.E. Therefore, the coefficients of sorghum nutrients obtained indirectly with sheep differ in magnitude and relative relation than when obtained directly with poultry.

TABLE 1.—The analysis, Digestion coefficients and feeding value of Barley grains, Sorghum grains, Rice starch by-product using digestibility trials with Egyptian poultry (Fayoumi Breed)

ITEM	Dry Matter	Organic matter	Crude Protein	Crude fat	Crude fibre	Soluble Carbohydrates N.F.E.	Ash	T.D.N.	Starch Value Kellner
	%	%	%	%	%	%	%	%	%
Barley grains									
Analysis as fed and feeding value	87.90	84.51	6.98	1.07	7.44	69.02	3.39	55.18	52.57
Analysis, dry matter and feeding value	100.00	96.15	7.95	1.22	8.46	78.52	3.85	62.77	59.80
Average digestion coefficients	61.14	64.44	73.05	49.93	-1.03	70.84	—	—	—
Average digestible nutrients as fed	53.74	54.46	5.10	0.53	0.00	48.89	—	—	—
Sorghum grains									
Analysis as fed and feeding value	87.81	85.02	9.74	1.15	6.59	67.54	2.79	64.64	62.09
Analysis, dry matter and feeding value	100.00	96.82	11.09	1.31	7.50	76.92	3.18	73.61	70.71
Average digestible coefficients	73.54	75.54	85.71	49.70	18.02	79.68	—	—	—
Average digestible nutrients as fed	64.58	64.22	8.35	0.57	1.19	53.82	—	—	—
Rice starch by-product									
Analysis as fed and feeding value	90.16	86.32	7.65	1.62	7.72	69.33	3.84	66.92	64.12
Analysis, dry matter and feeding value	100.00	95.74	8.49	1.80	8.56	76.89	4.26	74.22	71.12
Average digestion coefficients	71.83	76.02	76.66	64.58	14.18	83.09	—	—	—
Average digestible nutrients as fed	64.76	65.62	5.86	1.05	1.09	57.61	—	—	—

Fingerling starch values are 53.28, 63.31 and 65.09 for barley, sorghum and rice starch by-product respectively, and the nutritive ratios for the respective feeds are 1 : 10.18, 1 : 14.83 and 1 : 9.59.

TABLE 2.—Variations in apparent digestion coefficients of Barley grains Sorghum grains, Rice starch by-product, using Digestibility Trials with Egyptian poultry (Fayoumi Breed)

Item	Dry matter	Organic matter	Crude protein	Ether extract	Crude fibre	Soluble carbohydrates
	%	%	%	%	%	%
Barley grains						
Cock No. 1	62.72	66.03	72.72	50.92	0.80	72.63
Cock No. 2.	61.53	64.84	74.05	55.05	0.70	70.96
Cock No. 3.	57.19	60.60	73.78	40.86	–3.69	66.59
Cock No. 4.	63.12	66.29	71.63	52.87	–1.94	73.19
Average	61.14	64.44	73.05	49.93	–1.03	70.84
Standard error of the mean	1.36	1.32	0.55	3.14	1.09	1.49
Sorghum grains						
Cock No. 5.	75.33	77.95	87.47	53.76	18.35	81.88
Cock No. 6.	66.90	68.22	82.13	47.50	3.57	72.92
Cock No. 7.	77.20	78.98	87.59	42.98	28.13	82.41
Cock No. 8.	74.75	77.00	85.64	54.55	22.03	81.50
Average	73.54	75.54	85.71	49.70	18.02	79.68
Standard error of the mean	2.27	2.47	1.27	2.74	5.23	2.26
Rice starch by-product						
Cock No. 9	74.35	77.23	77.87	68.92	20.57	83.67
Cock No. 10	67.90	70.87	72.38	59.70	–1.57	79.02
Cock No. 11	76.19	79.11	79.51	61.15	24.20	85.59
Cock No. 12	75.37	78.33	80.06	72.54	21.68	84.59
Cock No. 13	71.40	74.40	76.73	55.77	9.92	81.76
Cock No. 14	72.99	76.20	73.46	69.42	10.28	83.91
Average	73.03	76.02	76.66	64.58	14.18	83.09
Standard error of the mean	1.24	1.23	1.29	2.70	3.98	0.96

The resultant of digestibility coefficients with poultry was reflected in the feeding value which was found to be 62.09% S.V. as fed (64.64 T.D.N.) against 74% S.V. with sheep (7,9). The 80 T.D.N. figure by Titus for the sorghum (Kafir) is higher than obtained with the sorghum sample here mostly due to the fact that the former sorghum contained higher protein and much less crude fibre.

Comparing the feeding value of barley grain and sorghum grain with poultry obtained here, it would be obvious that the sorghum feeding value was ca. 10 dgrees of percentage more. This may be due to the different nature of the crude fibre in both grains. The crude fibre with barley, being indigestible, appears to suppress more the digestion of other nutrients. It was also important to notice that both types of grains have practically the same fedding value with sheep (74 - 75% S.V.) whereas sorghum grains have 18% more feeding value than barley. Therefore the relative feeding value of both grains differed according to the physiological differences in digestion for both species.

The composition, digestion coefficients and feeding value of rice starch by proudct

The composition of the by-product used was generally similar to that published before (9), the protein, ether extract and N.F.E. being slightly lower but the crude fibre distinctly higher (7.72% against2.28%). Its composition was very similar to that of the barley grains.

The average digestion coefficients using 6 cocks was 76.02 ± 1.23 with organic matter, 76.66 ± 1.29 with protein, 64.58 ± 2.70 with ether extract, 14.18 ± 3.98 with crude fibre and 83.09 ± 0.96 with N.F.E .The agreement with all nutrients except crude fibre was satisfactory among the individual cocks. Crude fibre digestion varied widely among the cocks from-1.57 up to 24.2 , the variability percentage was distinctly high being ca. 70%. The individual cocks appeared to vary among themselves in their ability to digest crude fibre. Such variation in crude fibre digestion would not have much weight in affecting calculated feeding value owing to the low content of the crude fibre in the food.

From the comparison with barley, it would be seen that the coefficients with rice starch by-product are higher with all nutrients, the crude fibre was noticeably digested. This resulted in a higher feeding value being 64.14% S.V. which is ca. 22% more than with barley. Moreover, inspite of the fact that the product contains less protein and more crude fibre than sorghum grains, its feeding value was 2 degrees of percentage more. It seems that the alkali treatment used in rice starch preparation has a bearing on the feeding value of the by-product, its physical structure would be quite different from barley grains where the plant cells and their frame work are left without rupture. Moreover, it seems that the majority of the N.F.E. in the by-product is from starch which has been proved to be 100% digested by poultry as found by Bolton 1957 (3).

Contrary to this, what has been found when comparing the digestion of N.F.E. of maize grains and that of maize gluten feed (29.7% protein and 5.6% crude fibre) in the previous paper (11). Whereas it was 80.7% with the grain it was only 17.3% with the by-product.. The same depression in digestion coefficient of the N.F.E. was found by Titus (12) and Fraps (4) with maize gluten feed resulting in a serious depression in the feeding value of the product (42% T.D.N. after Titus and 35% T.D.N. by the authors Ref. 11). It was also observed that some poultry feeds as beans and undecorticated cotton-seed meal (45% protein) as published by Fraps, have a distinctly low digestion coefficient for the N.F.E. (41 and 36% respectively), resulting in a depression in the feeding value. The reason for this is questionable needing further investigation perhaps by detailed studies on the crude fibre and N.F.E. of poultry feeds. In this connection Bolton (3) found that while starch and sugar is 100% digested with poultry, cellulose and lignin are not, the pentosans are only digested from 5.6 to 36.5%. It has also been found recently (5) that an appreciable part of lignin and celulose itself is present in the N.F.E. as well as in the crude fibre fraction prepared from foods and faeces in digestion trials with sheep.

The suitable feeding standard for poultry

Several workers, particularly in the U.S.A. apply the T.D.N. system being easy to calculate. Others, particularly Titus, prefer the T.D.N. system allied with calculation of the metabolizable energy, for relative comparison of the feeding value of poultry feeds. He prefers to rely on the metabolizable energy value which would remain fairly constant. He resents the productive energy values introduced by Fraps in poultry nutrition, being variable according to the types of production.

But in Europe and Egypt, the starch value system after Kellner with ruminants is widely used; its preference is mostly due to the fact that this system considers, the effect of the crude fibre by using appropriate deduction. With ruminants the T.D.N. system undoubtedly overestimates the feeding value particularly with coarse foods. With concentrated foods, the T.D.N. figure very approximately equals the S.V. one so that the relative comparison of the feeding value with concentrates using either the T.D.N. or starch value system would be very approximately the same.

Moreover, the metabolizable energy with poultry is calculated from the T.D.N. by Titus using appropriate factors with each digestible nutrient according to its source. With the S.V. system, metabolizable energy is more easily calculated from the average metabolizable energy produced by unit S.V. Kellner found that 3.761 calories are produced per gram S.V. with ruminants while Fingerling found 4. 077 calories with pigs. It was therefore interesting to compare these variable systems and to see their effect on the relative value of the feeding value of poultry rations. Fingerling S.V. with pigs using his factors were also calculated for comparison.

Comparison of the absolute values

The data in Table 3 with six foods revealed the fact that Kellner's S.V. was very approaching the T.D.N. figure; the difference ranged between 1.49 to 3.51 degrees of percentage. But Fingerling S.V. was closer to the T.D.N. figure, the difference being 0.31.to 1.9 degrees. The percentage difference between the T.D.N. and Kellner's S.V. (table 4), ranged between 2.05 and 9.75% the average being 5.66%, In case of Fingerling S.V. the percentage difference was much less being between —0.43 and 4.5% with an average of 2.24%.

Therefore, it seems in practice for poultry feeding that the T.D.N. system practically give the same value as Fingerling S.V. which proved to be closer and should logically replace the Kellner's S.V. with sheep. Still the Kellner S.V. applied before have a small deviation of ca.6% from the T.D.N. figure.

Regarding the metabolizable energy, the results in Table 3 show that using Titus method gave practically the same value as when clacualted from Fingerling S.V. using his average metabolialble energy figure. The percentage decrease ranged between 0.61 and 5.36% the average being 2.95% from Titus values. But the metabolizable energy calculated using Kellner's system were appreciably lower; the percentage decrease ranged from 11.39 and 17.50 (average 13.38). Using Kellner S.V. and Fingerling factor, the results were closer, the percentage decrease was 3.39 up to 10.53 being 6.06 on an average.

From this study it was clear that Fingerling starch value and the metabolizable energy calculated from it are more suitable as feeding standards which give absolute figures practically the same as the T.D.N. and the metabolizable energy calculated from it after Titus. Fingerling method for calculating metabolizable energy is easier than that of Titus.

TABLE 3.—The feeding value of some poultry feeds using different standards and their relative values assuming barley as 100 using digestibility trials with Egyptian poultry (Fayoumi Breed)

Item	Barley grains	Sorghum grains	Rice Starch by-product	Maize *	Fine * wheat bran	Maize * gluten feed
Absolute values						
T.D.N.	55.18	64.64	66.84	72.07	36.00	34.76
Starch value S.V. (Kellner)	52.57	62.09	64.14	70.58	32.49	31.50
Starch value S.V. (Fingerling) .	53.28	63.31	65.09	72.38	34.38	34.20
Metabolizable energy, (M.E.), Calories						
from T.D.N. (Tisus) . . .	229.87	265.93	270.45	299.58	148.11	135.91
S.V. Kellner (3761). **	197.72	233.52	241.23	265.45	122.19	118.47
S.V. Kellner (4077) **	214.32	253.14	261.49	287.75	132.46	128.42
S.V. Fingerling(4077)**	217.22	258.11	265.37	295.09	140.17	139.43
Relative values						
Absolute T.D.N.	100.00	117.14	121.13	130.61	65.23	62.99
Kellner starch value or M.E. from it	100.00	118.11	122.01	134.26	61.80	59.92
Fingerling Starch value or M.E. from it	100.00	118.82	122.17	135.82	64.53	64.19
Titus M.E. from T.D.N. .	100.00	115.66	117.64	130.31	64.42	59.12

* Date from preisous paper (11). ** Calories per gram S.V.

TABLE 4.—The percentage decrease of the feeding value from: T.D.N. as absolute or from the metabolizable energy (M.E.) calculated after Titus

Item	Barley grains	Sorghum grains	Rice starch by-product	Maize	Fine wheat bran	Maize gluten feed	Average
% Decrease from T.D.N.							
S.V. Kellner	4.78	3.96	4.14	2.05	9.75	9.38	5.66
S.V. Fingerling	3.40	2.05	2.60	—0.43	4.50	1.32	2.24
% Decrease from T.D.N. as metabolizable energy (Titus)							
Kellner M.E. (3761)	13.79	12.54	12.20	11.39	17.50	12.83	13.38
Kellner M.E. (4077)	6.52	5.08	5.30	3.39	10.53	5.51	6.06
Fingerling M.E. (4077)	1.56	3.20	4.40	0.61	5.36	2.60	2.95

Comparison of the relative feeding value

Results in Table 3 indicate that the relative feeding value of the six poultry feeds, either by using the T.D.N. system, the kellner S.V., the Fingerling S.V. or the methods relying no metabolizable energy, were practically the same assuming the value for barley to be 100. The range of relative feeding value using these systems for each feed was narrow being 115.7-118.8 with sorghum grains, 117.6-122.2 with rice starch by-product, 130.3-135.8 with maize, 61.8-65.2. with fine wheat bran and 59.1-64.2 with maize gluten feed.

Therefore, using any of the these systems could give a true picture about the relative feeding value. Kellner's S.V. and his metabolizable energy factor should not be used; Fingerling's is better for giving absolute figures comparable with those by Titus. In feeding practice, the simplest method should be applied. The T.D.N. system as well as the starch value one after Fingerling are recommended to be applied giving both absolutely or relatively the same feeding value figures.

ACKNOWLEDGEMENT

The authors wish to express their gratitudes to Dr.A. A. El-Itriby, Director General of the Animal Production Dept., Ministry of Agriculture, Dokki, for his support, kind facilities and interest in the subject.

REFERENCES

1. **Abou-Raya, A.K.,** (1951).—A study of the lignin fraction in feeds and its significance in animal nutrition studies, *Ph. D. Thesis Edinburgh University.*

2. **A.O.A.C.,** (1955).—Official Methods of Analysis., *7th Ed.*

3. **Bolton, W.,** (1957).—The digestibility by adult fowls of wheat fine midlings, maize germ meal, maize gluten feed, soya bean meal and ground-nut meal. *J. Sci. Food Agric.* **3** : 132-136.

4. **Fraps, G.S.,** (1946).—Compositi n and productive energy of poultry feeds and rations. *Tex. Agr. Exp. Sta. Bull.* **678.**

5. **Galal, A. Gh.,** (1962).—A study of the composition of the crude fibre and the nitrogen free extractives in different feeding stuffs and their relation to the feeding value. *M.Sc. Thesis, Cairo University.*

6. **Ghoneim, A.,** (1958).—Principles of Animal Nutrion. *8th Ed. Maktabait El-Oloum (Arabic text book).*

7. **Ghoneim, A.,** (1958).—Animal Nutrition. *5th Ed. Anglo Egyptian Library (in Arabic).*

8. **Kenller, O.,** (1926).— The scientific feeding of animals. *2nd Ed. Authorised translation by William Goodwin, Duckworth London, W.C.*

9. **Ministry of Agric. Animal Production Dept. (Nutrition).,** (1961). — Feeding animal and Poultry. *Government publication (in Arabic).*

10. **Moon, F.E. and Armstrong, B.Th.,** (1937). — The digestion of huskless oats by poultry. *J. Agric. Sci.,* **27** : 458.

11. **Raafat, M.A., Abou-Raya, A.K., Aboul-Seoud, A.A. and Ismail, M.F.,** (1962).— Digestibility trials with Egyptian Poultry to study the feeding value of some feeding stuffs. I. study with maize grains, maize gluten feed and fine wheat bran. *First Animal Nutrition Congress, Minia, pp.* 85 *(in Arabic).*

12. **Titus, H.W.,** (1961).—The scientific feeding of chickens. *4th Ed. The Interstate., Daniville, Illinois.*

(Printed in (1966)

تجارب هضم مع الدواجن المصرية لدراسة القيمة الغذائية لبعض مواد العلف

أحمد أبو ريا ، محمد على رأفت ، أحمد أبو السعود ومحمد اسماعيل

الملخص

لقد درست القيمة الغذائية لحبوب الشعير والذرة الرفيعة واحد متخلفات نشا الأرز فى تجارب هضم على الدجاج الفيومى . ووجد أن الشعير تركيبه ٦ر٩٨ بروتين ، ١ر٠٧ دهن ، ٦٩ر٠٢ كربوايدرات ذائبة ، ٧ر٤٤ الياف ، ٣ر٣٩ رماد و١٢ر١٠ رطوبة وكانت معاملات الهضم للأربعة مركبات الغذائية الأولى على الترتيب هى : ٧٣ر٠٥ ، ٤٩ر٩٣ ، ٧٠ر٨٥ و١ر٠٣ وكانت المركبات المهضومة الكلية ٥٥ر١٨ ويقابلها معادل نشا ٥٢ر٥٧ ، وفى حالة الذرة الرفيعة كان يتركب من ٩ر٧٤ بروتين، ١ر١٥ دهن ، ٦٧ر٥٤ كربوايدرات ذائبة ، ٦ر٥٩ ألياف ، ٢ر٧٩ رماد ، ١٢ر١٩ رطوبة . وكانت معاملات الهضم للأربع مركبات الأولى هى ٨٥ر٧١ ، ٤٩ر٧٠ ، ٧٩ر٦٨ و١٨ر٠٢ على الترتيب . وكانت المركبات المهضومة الكلية ٦٤ر٦٤ مقابل معادل نشا ٦٢ر٠٩ . وفى حالة متخلف نشا الأرز كان التحليل الغذائى له ٧ر٦٥ بروتين ، ١ر٦٢ دهن ، ٦٩ر٣٣ كربويدرات ذائبة ، ٧ر٧٢ الياف ، ٣ر٨٤ رماد و٩ر٨٤ رطوبة . وكانت معاملات الهضم للمركبات الأربعة الأولى هى ٧٦ر٦٦ ، ٦٤ر٥٨ ، ٨٣ر٠٩ و١٤ر١٨ على الترتيب . وكانت المركبات له ٦٦ر٩٢ مقابل ٦٤ر١٢ معادل نشا ، وواضح من هـذه الدراسة أن القيمة الغذائية لهذه المواد على الدواجن تقل بشكل ملحوظ عن نظيرها فى حالة الغنم وان معـامل هضم الألياف يقـل بشـكل ملحوظ عن نظيره للمركبات الأخرى فلم يزد عن ١٨٪ فى المتوسط .

وقد وجد أن انسب مقياس لغذاء الدواجن هو المركبات المهضومة الكلية والقيمة النشوية لفنجرلنج ، فلكلا الطريقتين من الناحيـة العملية نفس القيمة الرقمية ، وكانت الحرارة الفسيولوجية النافعة المحسوبة من المركبات المهضومة بعد تيتوس تساوى من الناحيـة العملية الأرقام المحسوبة من معـادل النشا لفنجرلنج الذى وجد أن كل كجم معادل نشا مع الخنازير يكافىء ٤٫٧٧ سعرا كحرارة فسيولوجية نافعة .