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The Interrelationship between Metabolizable Energy (ME) and some Conventional Feeding Standards for Poultry Rations

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SEVEN metabolism trials with adult Fayoumi cocks were undertaken using four birds in each. In one trial, 3 White Plymouth Rock (W PR) cocks were used for comparison with Fayoumi cocks. The metabolism trials were undertaken for the determination of ME, digestibiltiy and feeding value of rations having a suitable range of crude protein and ME levels ; mixtures were further used in comparative feeding experiments with growing chicks.

Results indicated that calculated ME values for experimental rations from recorded figures for their separate ingredients were 9.4 - 12.9% higher than calorimetrically determined ME. The deviation in calculated crude protein% (CP) was 4-9.6% lower than determined crude protein. This indicated that in comparative feeding studies reliance should be on actually determined ME and CP values.

The differences between the corrected ME for retained N and classical ME values were negligible, not exceeding 2.61%. Therefore, such N correction for ME appeared to be unnecessary.

In balanced rations, it appeared that applying uranyl acetate or trichloro acetic acid for determining directly faecal N in digestion trials with poultry, produced practically the same values of digestible CP, NFE and calculated TDN, the percentage difference being not exceeding 4.16%, 0.32% and 0.52% respectively.

Results also indicated that multiplying TDN, apparent SV or true SV by the corresponding factors of 4.2, 4.0 or 4.185 Kcal/g would practically produce an ME figure of the diet per 100 g comparable with that calorimetrically obtained. It was also suggestive from the results to use a value number (Wertigkiet) of 95% with poultry feeds to calculate "true SV".

Numerous investigators tried to find out the most reliable or easiest methods for assessing energy of feed mixture with poultry. The energy of feed can be expressed as gross, digestible, metabolizable or net. The direct determination of digestible energy values with poultry is dfficult due to the problem of separating the faeces from the combined excreta. The determination of net energy values is laborious requiring very specific equipments (such as the respiration calorimeter or chamber for determining carbon and N balance) or determined using certain slaughter techniques and applying certain eqautions (according to Fraps system 1946 for determining the productive energy (PE).

Metabolizable energy (ME) values are relatively simpler to obtain with poultry and provide a measure of the feed energy which is available to the birds for the various physiological body processes (maintenance and production). The term ME with poultry is the energy of the food eaten less the energy of the excrement derived from both faeces and urine. ME values are available for poultry feeds using the calssical method by some workers (Fraps *et al.*, 1940, Olsson 1950 , Halnan 1951, Carpenter and Clegy 1956). Later on, the classical ME values were corrected for nitrogen equilibrium as suggested by several workers (Hill and Anderson 1955 , 1958, Hill *et al.* 1960, and Sibbald and Slinger 1963).

Metabolizable energy values have been computed indriectly from digestibility data for many feeding-stuffs by using suitable values for ME for each digestible nutrient following the figures indicated by Axelson and Erikson (1951) , and Titus (1961).

Fraps *et al.*,(1940), found that the metabolizable energy can be calculated by a knowledge of what be called "effective digestible nutrients" EDN excluding the digestible crude fiber in the calculation. This figure was practically the same as that of TDN. They considered that each gram EDN is equivalent to 4.2 Kcal ME, and using 4.2 Kcal per gram TDN would practically produce the same ME figures.

Sibbald *et al.* 1960 reported that the usefulness of ME values in the formulation of poultry ration relies on the assumption that the ME values of an ingredient is independent of the other diet component . They added that ME value remains relativley constant irrespective to the age or type of experimenttal birds.

This work was undertaken to study the interrelationships among ME figure, corrected ME as well as other conventiaonl feeding standards.

Material and Methods

The experimental work was carried out at Dokki Poultry Farm, Animal Production Department, Ministry of Agriculture. The analytical work was performed at the laboratories of the same Department.

Adult Fayoumi cocks were used in 7 metabolism trials with four birds housed individually in metabolism cages for each trial. Three adult white Plymouth Rock cocks were used in one tiral for comparison with Fayoumi cocks. Seven experimental feed mixtures (intended to contain wide range of ME and CP levels) as shown in Table 1, were used for the metabolism trials. The preliminary period continued 4 days as well as the collection period. The well mixed excreta were dried daily at 70° overnight to form a composite sample which was finely ground before storing.

Faecal N was determined directly in the excreta according to the method of Eckman *et al.* (1949) deproteinizing with uranyl acetate. Deproteinizing with trichloro-acetic acid was also applied(Jackobsen *et al.*,1960) for comparison in feed mixtures. Urinary organic matter was calculated assuming that each unit N corresponds to 2.62 units urinary organic matter as deduced by Galal (1969)(assuming that the percentage scatter of urinary N was 62.9 from that uric acid, 17.3 from ammonia, 10.4 from urea and 9.4 from creatine plus other components as inicated by Sturkie 1954).

TDN was determined in the usual method (using the factors 1, 2.25 and 1 for digestible CP, crude fat and curde carbohydrate respectivley). While the conversion factors of Buchman (queted by Ghoneim, 1964) to calculate apparent starch were 1.03, 3.11, 1.00 and 1.00 in respective order. True S.V. was calculated at first using 0.3 unit of curde fiber deduction and later a suitable crude value No of 95 was suggested for poultry feed mixtures as will be discussed from the results.

Determination of metabolizable energy

The dried and finely ground samples of feed and excreta were assayed for gross energy using the adiabatic bomb calorimeter following instruction. Benzoic acid dried at a temperature not more than 5°C above its melting point (122°C), was used for checking the apparatus. Metabolizable energy (Feed energy-Excreta energy) was determined per gram dry matter of the feed using the simplified equation :

ME/g feed = GE/g feed—Dry matter ratio x G.E/g excreta

Corrected ME to equilibrium balance of N was undertaken as proposed by Titus *et al.*,(1959) substracting 8.73 Kcal ME for each 1g N of the positive balance using the simplified equation :

Corrected ME/g feed = Classical ME/g feed – (N/g feed—dry matter ratio x N/g excreta) x 8.73.

Analysis for moisture, nitrogen, crude fiber, ether extract and ash were made for feed, dried excreta and according to the methods of the A.O.A.C., (1965)

Statistical analysis was carried out according to Snedecor (1959).

Results and Discussion

Calorimetric determination of metabolizable energy values for experimental rations.

The average values of classical ME (feed energy-excreta energy) in Kilocalories per gram dry ration, were 2.400±0.032, 2.550±0.009, 2.746±0.013, 2.971±0.016, 1.904±0.074, 2.247±0.024 and 3.106±0.020 for rations 1,2,3,4,5,6 and 7 repectively (Table 2). However the respective coefficient of variation was 2.28%, 0.71%, 0.82%, 1.06%, 7.77%, 2.15% and 1.32%. It is obvious that values of classical ME within individual cocks for each ration differed slightly so that the variability ranged from 0.71% to 2.28% with the exception of ration 5 which had a relatively high variability (7.77%). These results confirm the reports of Hill and Anderson, (1955, 1958), Anderson *et al.* (1958) potter *et al.* (1960) and Titus (1961) who found that ME is more precisely measured than the productive energy. Abdella (1970) found that the variability of determined productive energy ranged between 0.86%, and 21.32% with Rhode Island Red chicks.

Correcting for retained N, ME values Table 2 were 2.342±0.029, 2.496±0.013, 2.688-0.013, 2.914-0.009, 1.864±0.007, 2.189±0.018 and 3.025±0.018 for the rations 1, 2, 3, 4, 5, 6 and 7 respectively. The average percentages of corrected ME from classical ME ranged between 97.39% and 98.05%. These differences were small, not exceeding 2.61% of the classical ME. In view of this finding, it might be claimed that the nitrogen correction does little to improve the classical ME data. Therefore, the classical ME determined in this experiment was used to study its interrelation with other feeding standards.

The concept of corrected ME for N retained appeared to need further studies from the academical and physiological sides before widening its application in comparative feeding studies.

Comparison between determined metabolizable energy and crude protein % and their calculated values for experimental rations

The energy and crude protein levels were at first calculated by a knowledge of the percentage portion of each ingredient for the ME figures recorded for such ingredient by Titus (1961). The calculated metabolizable energy values were about 10% higher (9.4, 11.7, 12.1 and 12.9% for rations 1, 2, 3 and 4 repectively) than those determined. The calculated crude protein values were 16, 18, 20 and 22% for rations 1, 2, 3 and 4 respectively, being slightly lower than those determined (Table 1). This indicated that in comparative feeding studies reliance should be on actually determined ME and CP values.

The effect of breed on metabolizable energy values

It was found that the classical and corrected ME, using ration 7 with WPR cocks are somewhat higher than those obtained with Fayoumi cocks (Table 2). The classical ME values were 3.217±0.026 Kcal with WPR and 3.106±0.0020 with Fayoumi, while the corresponding corrected ME values were 3.106±0.018 and 3.025±0.018 Kcal. The difference between either the classical ME values of the two breeds or between the corrected values was significant only at 5% level and not significant at 1% level. Sibbald and Slinger (1963) and Slinger *et al* (1964). showed that breeds metabolized the energy of their feed differently. The higher ME values with WPR cocks than those obtained with Fayoumi ones, might indicate that WPR cocks metabolized more energy per unit of feed than did Fayoumi cocks.

TABLE 1. **Percentage composition and proximate analysis of experimental rations (Feed mixtures)**

Ingredients	Ration No.						
	1	2	3	4	5	6	7
	%	%	%	%	%	%	%
Yellow Corn	25	34.5	45.5	49	10	10	54.5
Rice bran (extracted)	32	20	8	3	37.5	37.5	3
Wheat bran	20	14	8	3	20	20	3
Corn gluten feed	5	5	4	4	4	4	4
Decorticated cotton seed meal	8	13	20	26	15	15	21
Sesame seed meal	3	5	5	4	4	4	5
Fish meal	2.5	3	3.5	4.5	3.5	3.5	3.5
Blood meal	1	2	2.5	3	2.5	2.5	2.5
Bone meal	1	1	1	1	1	1	1
Lime stone	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Sodium chloride	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Mineral mix.*	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Supplements							
Vitamin mix**	+	+	+	+	+	+	+
Manganese sulphate (p.p.m)	150	150	150	150	150	150	150
Corn oil. Kg/100 kg feed	—	—	—	—	—	—	—
Lard kg/100 kg feed	—	—	—	—	—	6.5	3.5
Proximate analysis							
Moisture	9.49	9.49	8.88	8.54	9.38	9.22	9.31
Ash	10.54	9.83	8.34	7.57	10.84	10.27	6.76
Crude protein	17.54	18.78	20.96	22.87	21.27	19.85	20.36
Crude fiber	6.85	5.99	5.66	5.01	7.83	7.09	3.95
Ether extract	3.43	4.31	4.16	7.21	4.52	10.11	8.62
N. free extract	52.15	51.60	52.00	48.80	46.16	43.46	51.00

* Commercial salt.

** One Kg of Vit. A-D_3 per ton of feed (each gram contains 5000 I.U. of Vit. A and 1000 I.U. of Vit. D_3

One Kg of Vit. B mix. per ton of feed (each kg contains 8.8 g riboflavin, 8.11 g pantothenic acid, 52.9 g niacin and 229 3 g choline chloride.

TABLE 2. Average results of determined metabolizable energy in various rations used in comparative feeding experiment. (Kcal per gram intake)

Ration	Determined classical ME			Corrected ME	
	Breed	as fed	in DM	as fed	in DM
1	Fayoumi	2.172	2.400	2.120	2.342
2	Fayoumi	2.308	2.550	2.259	2.496
3	Fayoui	2.502	2.746	2.449	2.688
4	Fayoumi	2.717	2.971	2.664	2.914
5	Fayoumi	1.724	1.904	1.688	1.864
6	Fayoumi	2.044	2.247	1.991	2.189
7	Fayoumi	2.808	3.106	2.734	3.025
7	W.P.R.	2.907	3.217	2.807	3.106

The differences in feed level might be also responsible for differences in metabolized energy per gram feed intake as it was 30.7 g daily per 1 kg liveweight with WPR and 43.8 with Fayoumi. Moreover, the consumption per 1 kg metabolic body size (W kg) 0.75 was also higher with Fayoumi being 50.0 g against 40.3 with WPR. However, such differences in ME/g could be practically neglected among breeds in comparative feeding experiments.

The effect of using trichloro-acetic acid in digestion trials with poultry using mixed rations

With balanced feed mixtures (Ration 1, 2, 3 and 4 in Table 3, having relatively high digestion coefficients of CP about 80%), applying trichloro-acetic acid, resulted in much smaller deviations than when applying uranyl acetate.

The average digestibility of CP was 84.78 (Table 4) using trichloro-acetic acid, being 82.23 when using uranyl acetate. Such differences could be neglected, being within differences of replicates in a digestion trials with poultry. Therefore, it appeared very applicable in feeding practice (and not single or two component feed mixture), could be taken as 80%.

Although the average percentage difference between CP digestibilities with uranyl acetate method and that of trichloro-acetic was negligible ranging between 1.12 and 4.16, yet this was reflected to less percent differences with NFE coefficients being between-1.12 and 0.32%. The perecent difference with calculated TDN was almost nil ranging between 0.13 and 0.52%.

TABLE 3. **Average digestion coefficient and feeding value for the first feed mixture (Ration 1, 2, 3, and 4).**

Ration No. 2	Dry matter	Av. digestion Coefficient				Av. feeding value	
		Crude protein %	Ether extract %	Crude fiber %	N. free extract %	TDN	True SV
1	53.95	85.16	71.83	4.08	47.74	50.87	51.38
2	56.07	83.99	74.85	3.20	62.06	55.25	56.69
3	59.27	86.05	77.95	7.75	64.26	59.19	60.82
4	60.37	84.11	81.80	1.81	65.39	64.51	68.66

TABLE 4. **The effect of using trichloro-acetic acid versus uranyl acetate on digestibility and feeding value of mixed rations**

Ration No.	Cock No.	Method of Analysis	CP digestibility	NFE Coef.	Feeding Value TDN
1	1	Trichloro acetic acid	85.55	58.83	51.49
		Uranyl acetate	82.20	59.49	51.24
		Difference	3.35	— 0.66	0.25
		% of difference	4.08	— 1.11	0.49
2	6	Trichloro-acetic acid	83.31	62.74	55.11
		Uranyl acetate	82.39	62.94	55.04
		Differences	0.92	— 0.20	0.07
		% of difference	1.12	— 0.32	0.13
3	3	Trichloro-acetic acid	86.44	65.16	59.84
		Uranyl acetate	82.98	65.96	59.53
		Difference	3.46	— 0.80	0.31
		% of difference	4.16	— 1.21	0.52
4	7	Trichloro-acetic acid	83.85	65.27	65.11
		Uranyl acetate	81.41	65.94	64.88
		Difference	2.44	— 0.67	0.23
		% of difference	3.00	— 1.02	0.35
	Average	Trichloro-acetic acid	84.78	63.00	57.89
		Uranyl acetate	82.23	63.58	57.67
		Difference	2.55	— 0.58	0.22
		% of difference	3.09	— 0.92	0.37

But with single feeds directly fed to cocks, Abou-Raya and Galal (1971) found that trichloro-acetic acid application resulted in an increase in digestibility of CP, slight decrease in NFE coefficient but negligible increase in TDN or SV. The absoulute differences in CP coefficient were relatively high, being higher when the coefficient was relatively low (with rice bran being 57.85 against 73.72).

Therefore, it was concluded that using trichloro-acetic acid with ordinary mixed poultry rations would lead to negligible differences when compared with uranyl acetate.

The validity of Fraps et al. factor (4.2 Kcal/g TDN) for indirect determination of metabolizable energy

By comparing the calculated ME figures (TDN$\times$4.2) with those directly determined calorimetrically with single cocks in the four trials (Table 5), there was no significant differences observed. The range of differences among 14 cocks was between-0.001 and 0.050 Kcal/g feed. The test of nil hypothesis revealed that the average differences in ME per gram feed was 0.0094$\pm$0.0064 Kcal ('t' being 1.469) indicating insignificance in the difference between the experimentally determined ME and those calculated using TDN and Fraps *et al.* factor.

TABLE 5. The relation between directly determined metabolizable energy (calorimetrically) and indirectly determined values from TDN

Ration No. Average	Cock No.	Direct determination of ME/g feed	Indirect calculated ME		Difference	Determined ME/unit TDN
			TDN %	Calculated* ME/unit TDN		
1	1,2,3	2.172	50.87	2.137	— 0.035	4.269
2	5,6,7,8	2.308	55.25	2.321	— 0.013	4.177
3	1 2,3	2.502	59.19	2.486	— 0.016	4.227
4	5,6,7,8	2.717	64.51	2.709	— 0.008	4.212
Overall mean		2.437	57.80	2.428	—0.0094	4.217

* Calculated ME was obtained according to Fraps *et al.*, (1940) (TDN, multiplied by 4.2 kcal).

Therefore, it was concluded that in mixed rations such as used in this study having a wide range of ME (2.117-2.738 Kcal/g feed or 2.431-2.994 Kcal/g dry matter), the figure 4.2 Kcal could be used to represent one gram

TDN in digestion trials. In this study with individual cocks, when dividing determined ME by corresponding TDN, the gram TDN was found to produce 4.152 up to 4.297, the average being 4.217 Kcal. The figure obtained here was practically the same as suggested by Fraps *et al.* (1940).

The relation between colorimetrically determined metabolizable energy and starch value after Buchman, (1946).

According to Buchman 1946 (cf. Ghoneim 1946) each 1 g true SV corresponds to 4.185 Kcal ME. When calculating the ME indirectly with individual cocks (Table 6,) to obtain apparent SV (assuming pure nutrients), the calculated (apparent) ME was on average of 4 cases, 5.6% higher than determined ME calorimetrically. This leads us to conclude that utilization of digestible energy from nutrients in feeds is slightly less than with pure nutrients. It was possible therefore to indicate that "true" or corrected metabolizable energy in mixed feed would be 94.67% that calculatded assuming pure nutrients, *i.e.*; 'apparent' ME. It was concluded that with poultry feeds an average 'wertegkief' or value number of 94.67% or 95% could be used to calculate true SV. Therefore, with poultry, fed on mixed diets, the true SV figures when multiplied by 4.185 Kcal would produce an ME figure for 100 g diet comparable with that experimentally obtained calorimetrically.

When using the apparent SV figure and calculating the average corresponding ME per gram apparent SV (Table 6), it was found to be 3.962 Kcal ranging between 3.841 and 4.093 Kcal. For practical purposes an average of 4.00 Kcal equivalent to each g apparent SV could be also suggested for indirectly obtaining true ME comparable with those calorimetrically obtained. In other words 1 g apparent SV in a feed coresponds to 4.0 Kcal ME. This figure is 95% of the 4.185 Kcal which is considered for 1 g pure digestible starch.

It was therefore suggestive to use a value number of 95% in poultry feeds to compute true SV figures from digestible nutrients according to Buchman's factors. It seems that using a crude fiber deduction of 0.3 % SV per unit CF% in feed as already used by Abou-Raya & Galal (1971) in digestion trial (analogous to Ghoneims suggestions with concentrates with sheep instead of the value number), appeared to correct somewhat the apparent SV figures but without experimental evidence. In fact when using the crude fiber deduction the calculated true SV figures were 1-2 percent degree higher than those calculated using the suggested value number.

Seeking more accuracy, testing the correlation between SV% and ME calorimetrically obtained, it was found to be almost unity (0.9914). The following two prediction regression equation were calculated.

$$ME = 3.343 \times \text{apparent SV} - 37.75 \qquad (1)$$

$$\text{Apparent SV} = 0.294 \times ME - 10.04 \qquad (2)$$

The equations would give more accurate figures for predicting ME indirectly, but the average 4.00 Kcal per gram apparent SV or 4.185 Kcal/g true SV is easier for prediction.

TABLE 6. The relation between directly determined metabolizable energy and starch value after Buchman (1946)

Ration No. Average	Cock No.	Directly determined ME/g Feed	Apparent SV	Determined ME/unit SV	True SV	
					Using C.F deduction	Using Vajue number
1	1·2·3	2.172	53.44	4.064	51.38	50.77
2	4·5·6·7	2.308	58.45	3.945	56.69	55.57
3	1·2·3	2.502	62.52	4.001	60.82	59.39
4	4·5·6·7	2.717	70.16	3.873	68.66	66.65
Over-all mean		2.437	61.61	3.962	59.86	58.53

References

Abdella, M.M.M., (1970). *Productive energy values of some feedstuffs for chickens.* Ph. D. Thesis, Fac. Agric., Cairo Univ.

Abou-Raya, A.K., abd Galal, A. Gh. (1971). Evaluation of poultry feeds in digestion trials with references of some factors involved. *U.A.R., J. Animal Prod., Vol. II,* No. 1

Anderson, D.L., Hill, F.W., Renner, R. (1958). Studies of the metabolizable and productive energy of glucose for the growing chick. *J. Nutrition,* 65, 561.

Association of Official Agricultural Chemists (A.O.A.C.) (1965). Official Methods of Analysis 10*th* Ed.

Axelsson, I. and Erikson, S. (1951). Determination of metabolizable energy in poultry foodstuffs and rations Proceed. 9*th* World's Poultry Congress 2 : 160-2.

Carpenter, K.J. and Clegy, K.M. (1956). The metabolizable energy of poultry feeding stuffs in relation, to their chemical composition. *J. Sci., Food Agric.,* 7, 45.

Ekman, P., Emanuelson and Fransson, A. (1949). Estimation of faecal protein. *K. lanthbrukse Ann.* 16, 749.

Fraps, G.S. (1946). Composition and productive energy of poultry feeds and rations *Texas Agric. Exp. Sta. Bull. No.* 678.

Fraps, G.S., Carlyle, C. and Fuge, I.F. (1940). Metabolizable energy of some chicken feeds. Texas *Agr. Exp. Sta. Bull. No.* 589.

Galal, A. Gh, (1969). *A study of some carbohydrate components of poultry feeds and their relation to the feeding value with rferences to lignin fraction.* Ph. D. Thesis Fac. Agric. Cairo Univ.

Ghoneim, A. (1964). "*Animal Nutrition, Principles and the feeding stuffs*" Anglo Egyptian Library, Cairo (A tetbook in Arabic).

Halnan, E.T. (1951). The nutritive (energy) value of poultry feeds. *Proceed. 9th World's Poultry Congress* 2 : 3-6.

Hill, F.W. and Anderson, D.L. (1955). Comparison of productive energy and metabolizable energy with chicks. *Poultry Sci.* **34**, 1201.

Hill, F.W. and Anderson, D.L. (1958). Comparison of metabolizable energy and productive energy determination with growing chicks. *J. Nutrition*, **64**, 587.

Hill, F.W., Anderson, D.L., Rebber, R.R. and Carew, Jr. L. b. (1960). Studies of the metabolizable energy of grain and grain products for chickens. *Poultry Sci.* **39**, 573.

Jakobson, P.E., Kirsten Gertovog, S. Hovgaard Nielsen, (1960). Fordjelighe ds Forg med fjerkrae "Digestibility trials with poultry" 322 beretning fra forsgslaboratoriet.

Olsson, N. (1950). Digestion expriments on poultry Kungl-lantbrukshogskolan statens Latbrukforsk-statens Husjursförsole Meddelande No. 43.

Potter, L.M., Matterson, L.D., Arnold, A.W., Pudelkiewiez, W.I. and Singsen, EP. (1960). Studies in evaluating energy content of feeds for the chicks 1-The evaluation of the metabolizable energy and productive energy of the alpha cellulose. *Poultry. Sci.* **39**, 1166.

Sibbald, I.R. and Slinger, S.J. (1963). A biological assay for metabolizable energy in poultry feed ingredients together with findings which demonstrate some of the problems associated with the evaluation of fats. *Poultry Sci.* **42**, 313.

Sibbald, I.R., Summers, I.D., and Slinger, S.J. (1960). Factors affecting the metabolizable energy content of poultry feed. *Poultry Sci.* **39**, 544.

Slinger, S.J., Sibbald, I.R. and Pepper, W.F. (1964). The relative abilities of two breeds of chicken and two varieties of turkeys to metabolize dietary energy and dietary nitrogen. *Poultry Sci.* **43**, 329.

Snedecor, G.W. (1959). "*Statistical Methods*" Fifth Ed. (second reprinting). Low State College Press, Ames, Iows, U.S.A.

Sturkie, P.D. (1954). "*Avian Physiology*". Constook Publishing Associates, Cornell Univ. Press, Ithaca, New York, P. 224.

Titus, H.W. (1961). "*The scientific feeding of chickens*". Fourth Edition. The interstate Danville, Illinois.

Titus, H.W., Mehring, Jr. A.L., Johnson, Jr., D. Nesbitt, L.L., and Tomas, F. (1959). An evaluation of M.C.F. (micro-cel-fat) a new type of fat product *Poultry Sci.* **38**, 1114.

العلاقة بين الطاقة الممثلة وبعض المقاييس الغذائية فى أغذية الدواجن

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قسم الانتاج الحيوانى ، كلية الزراعة ، جامعة القاهرة ، فرع بحوث الدواجن ، معهد الانتاج الحيوانى ، وزارة الزراعة

تم اجراء سبع تجارب تمثل غذائى مع ديوك الفيومى البالغة باستخدام أربعة طيور فى كل . وفى تجربة أخرى استخدم ثلاثة ديوك من بليموثروك الأبيض وذلك للمقارنة مع ديوك الفيومى ، وأجرى فى كل تجربة تقدير الطاقة الممثلة ، ومعاملات الهضم والقيمة الغذائية للعلائق المستخدمة يتراوح منها مستوى البروتين والطاقة الممثلة : حسب تعميم تجارب التغذية المقارنة ، التى أستخدمت فيها مخاليط العلائق مع الكتاكيت النامية وتثبت النتائج أن الطاقة الممثلة المحسوبة لعلائق التجارب باستخدام النتائج المعلنة عن كل مادة علف منفردة ، تزيد ٤ر٩ – ٩ر١٢٪ عما قدرعمليا باستخدام مسعر الحرارة ، ولكن كان انحراف نسبة البروتين المحسوبة عن المقدرة كيماويا فى المخلوط لايزيد عن ٤ـ٦٠٩٪ ، وهذا يوضح أنه فى تجارب التقدر المقارنة بين علائق مختلفة يجب تقدر كل من الطاقة الممثلة ومستوى البروتين فى كل مخلوط تقديرا مباشرا .

ولقد كان الفرق بين الطاقة الممثلة المعدلة للنتروجين المحتجز وتلك بدون تعديل يمكن اهماله حيث لم يزيد عن ٦١ر٢٪ ، وعلى ذلك فهذا التعديل يبدو أنه لا لزوم له .

وفى الأغذية المتزنة ، يبدو أن استخدام مادة خلات اليورانيل أو ترأى كلورو حامض الخليك للتقدير المباشر لازوت الروث فى تجارب هضم مع الدواجن ، يعطى عمليا نفس النتائج لمستوى البروتين المهضوم والمستخلص خالى الازوت المهضوم ومقياس المركبات المهضومة الكلية اذ لم تعد نسبة الفرق ١٦ر٤ ، ٣٢و٠ ، ٥٢و٠٪ على التوالى .

كما ثبت أن ضرب مقياس المركبات المهضومة الكلية فى ٢ر٤ أو معادل النشا الاسمى فى ٤ أو معادل النشا الحقيقى فى ١٨٥ر٤ كيلوكالورى يعطى عمليا رقم الطاقة الممثلة فى العليقة لكل ١٠٠ جم وهذا يماثل ما يتحصل عليه عمليا باستخدام جهاز المسعر . وقد اقترح أيضا من نتائج البحث استخدام معامل الغذاء المفيد ٩٥٪ مع الدواجن لتحويل معادل النشا الظاهرى الى معادل النشا الحقيقى .