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BIOAVAILABLE ENERGY VALUE AND DIGESTIBILITY OF WHOLE MELON SEEDMEAL (*COLOCYNTHIS CITRULLUS*, L). IN BROILER CHICKENS.

B.M ORUWARI, U.I. OJI, AND R. O IWUAGWU
Animal Science Department
Rivers State University of Science and Technology.
PMB. 5080, Port Harcourt, Nigeria.

Target Audicence: poultry farmers and animal scientists

ABSTRACT

Twenty physiologically (adult) mature broiler chickens paired on equal weight basis were starved for 24 hr to void completely previous feed residues. Ten of the birds were force- fed 30g dry matter (DM) of toasted or untoasted melon seedmeal (TMSM or UTMSM) as slurry. Before forming the slurry, the feeds were sampled for proximate analysis. The other ten birds were starved as a control group for the estimation of the metabolic faecal and endogenous urinary losses. Excreta were quantitatively collected at 24, 48 and 60 hr post-prandium and part of each sample was taken for proximate analysis for calculation of their percent digestibility while the other part along with the meals were used as sample for gross energy determination. Results showed that 48hr represented the period when faecal residues were totally voided. The true metabolisable energy (TME) and the true dry matter digestibility of TMSM and UTMSM were 4.94, 4.80 (Kcal/g) and 73.14, 68.65, (%) respectively. The TME estimate was significantly higher than the other energy systems. Toasting melon seeds did not affect nutrient availability and digestibility. Also the study shows that digestibility studies may be used to enhance the accuracy of bioavailable energy data.

Key words: Whole melon seedmeal, broiler chickens, digestibility.

DESCRIPTION OF PROBLEM

The bioavailable energy component of a diet accounts for approximately 70% of the cost of feed or diet therefore putting the cost of energy portion of the diet at 50% of the farm gate cost of poultry products (1). Accordingly the need to source a cheap and locally available feed ingredient such as whole melon seedmeal, necessitated this study. Some unconventional feed ingredients such as spent bleaching clay, a bentonite product from canola oil refining (2), fermented poultry manure (3), palm oil slurry (4) and maggots (5) have been tested and found to be useful alternative feed ingredients. However, a knowledge of the chemical and energy content of the feed ingredients is an important prerequisite in compounding rations for livestock and poultry. The bioavailable energy content of feed ingredients determines the intake of other nutrients in the diets because, animals eat to satisfy their energy requirements when fed *ad libitum*. Bioavailable energy is decriptive

decriptive and more precise estimate that could be used in feed formulation (6) Full fat whole melon seedmeal may be classfied as a good quality dietary ingredient, being rich in essential amino acids and high in protein and oil (7,8). It may also be high in energy value because of the high oil content within the matrix of the seeds (9) This present study was conducted to detemine the proximate composition, bioavailable energy and nutrient digestibility of whole melon seed meal using mature broiler chicken.

MATERIALS AND METHODS

Twenty physiologically mature broiler chickens (Anak) were selected on equal weight basis to determine the bioavailable energy and nutrient digestibility of whole melon seedmeal. The birds were removed from the rearing units in deep litter to the metabolic cages where they were placed in an open-sided house. They were kept for one week before the balance trial commenced to enable them adapt. The experimental layout was the completely randomised design, each bird representing one experimental replicate, therefore, having a total of 10 replicates while the remaining ten birds served as the control group. The birds in the control group were starved throughout the experimental period while the other ten were fed.

Some portion of the melon seeds was toasted in a force-draught oven maintained at 100°C for 15min, and both the toasted and untoatsted melon seeds were ground using an electric milling machine (2.00mm screen). The proximate analysis of samples of melon were determined according to (11). Correction was made for moisture content of the feedstuffs such that 30g dry matter (DM) of either the toasted or the untoasted whole melon seed meals weighed out into ten places were fed the ten test birds . An assay avoiding feeding the birds through crop intubation (12) was adopted. Each of the ten birds was force-fed 30g whole DM melon seedmeals in slurry by careful introduction.

Before feeding the test group, all the birds were starved without water for 24hr to completely clear undigested materials in their digestive tracts. While the ten test birds were force-fed, the other ten birds (control) were starved throughout the experimental period and were used to estimate the metabolic faecal and endogenous urinary energy. Water was added to the troughs attached to the metabolic cages when the birds were fed.

Faecal material were quantitatively collected at 24, 48 and 60 hr post-prandium. Polythene sheets were spread on top of the faecal receptacles located beneath the metabolic cages where the faeces were completely scooped with a spoon into empty cans . A simulated oven made of metabolic cage and electric bulbs was used to dry the faeces on the farm before they were trasferred into a force draught oven in the laboratory for final drying.

The dried faeces were weighed, bagged in small plastic bags and stored in desiccators. Part of each sample was taken for the determination of proximate analysis and subsequent calculation of the nutrient digestibility coefficient

of toasted and untoasted whole melon seedmeals (13, 14, 15,) while the other part was used to obtain the gross energy (GE) . The Parra diabatic oxygen bomb calorimeter was used to determined the GE of both the whole melon seedmeals and faeces. Bioavailable energy values were calculated using the methods of (6, 16).

All data were subjected to analysis of variance and differences between treatment means were separated using Tukey pairwise comparison (10).

RESULTS AND DISCUSSION

The proximate analyses for toasted melon seedmeal (TMSM) were 3.88, 29.23, 55.09, 7.45, 0.62 and 0.52% for moisture, crude protein, ether extract, ash, calcium and phosphorus, respectively. The values for the untoasted melon seedmeal (UTMSM) were 6.75, 28.93, 51.0, 6.75, 0.54. and 0.91% for moisture, crude protein, ether extract ash, calcium and phosphorus, respectively.

The TMSM contained less water but relatively higher protein, ether extract ash, calcium (Ca) and phosphorus (P) than the UTMSM . The bioavailable energy values which include apparent metabolizable energy (AME), apparent metabolizable energy corrected to nirogen balance (AMEn), true metabolizable energy (TME) and true metabolizable energy corrected to zero nitrogen balance (TMEn) of whole melon seedmeal obtained at 24, 48 and 60 hour post-prandium are presented in Tables 1 and 2. The AME and AMEn estimates of UTMSM decreased significantly ($P< 0.05$) with time (Table 1)

Table 1: Different bioavailable energy values of toasted melon seedmeal (TMSM) at different faecal collection periods

Collection periods (hr)	AME	AMEn	TME	TMEn
		(kcal \gm)		
24	4.71^{a}+0.05	4.46^{b}+0.04	5.00^{a}±0.05	4.69^{a}±0.04
48	4.26^{b}+0.04	4.09^{c}+0.04	4.80^{b}±0.03	4.51^{b}±0.04
60	4.11^{c}+0.04	3.97^{a}+0.03	4.77^{c}±0.02	4.49^{c}±0.02

^{a,b,c,d,e} Means within the column not having the same superscript are significantly ($P<0.05$) different

The crude protein contents of the whole melon seedmeals were not affected significantly by toasting, and these values were close to 29.82 % obtained by (7), but were lower than the 32.50 to 38.69 % range reported by (8), such differences may result from nitrogen fertilizer application which increases the nitrogen content of the plant (17). The ether extract values of toasted (55.09%) and untoasted (51.00%) whole melon seedmeal were similar to 49.60 and 53.59% reported by (7) and (8) respectively. These finding showed that toasting melon seed does not alter its chemical composition since both remained full fat. Toasted melon seedmeal on the other hand, is slightly greater

in ash, calcium and phophorus contents than the untoasted. The calcium and phophorus values in this study differed with the values reported by (8). Again these differences could be due to soil differences since crops grown on soils deficient in some mineral elements will be deficient in those minerals (17)

The apparent metabolisable energy for the 24 hour data were significantly greater than those of 48 and 60 hour. However, for TMSM, the TME and TMEn were not affected by faecal collection periods

The energy profile of TMSM in Table 1 showed significant AME, and also in the AMEn, TME, and TMEn . The AME, AMEn, TME, and TMEn values of UTMSM at 24hr were significantly greater ($P< 0.05$) than those of TMSM.

The AME values implied that 48 hr was adequate for complete passage of the faecal material. Consequently, the energy output per hour method (13) was used to determine that 48hr was required for complete excretion of unabsorbed UTMSM, and TMSM.

Table 2: Different bioavailable energy values of untoasted melon seedmeal (UTMSM) at different faecal collection periods

Collection periods (hr)	AME	AMEn	TME	TMEn
	(kcal \gm)			
24	4.94^{a}+0.089	4.69^{a}+0.08	5.26^{a}+0.05	4.94^{a}+0.08
48	4.39^{b}+0.12	4.20^{b}+0.11	4.94^{b}+0.11	4.63^{b}+0.114
60	4.25^{c}+0.13	4.08^{c}+0.12	4.19^{c}+0.11	4.59^{c}+0.114

^{a,b,c,d,e} Means within the row not having the same superscript are significantly ($P <0.05$) different

Similarly, the energy measurement of TMSM suggested that 48hr post-prandium was required for total excretion of this feed residue. The results suggested that in both feedstuffs (UTMSM and TMSM) the faeces collected at 60hr were metabolic and endogenous materials. Indeed, toasting melon seeds appeared to reduce the bioavailable energy contents in this study. In all cases, the bioavailable energy values of UTMSM suggest that there was no beneficial biological effects of toasting melon seeds. This contrasts the report that toasting of edible seeds such as soyabean had biological and economic advantage although soyabean and melon differ in characteristics and physiology (18).

The apparent and true digestibilities of UTMSM and TMSM are presented in Tables 3 and 4. Apparent protein digestibilty (APD), true protein digestibility (TDP), apparent dry matter digestibility (ADMD) and true dry matter digestibilities (TDMD) of UTMSM and TMSM showed significant differences at 24, 48 and 60 hr. (Tabes 3 and 4).

The results of APD estimates of UTMSM tended to suggest that more than 24hr was needed for complete clearance of feaces but this time difference was not observed when the data were corrected for metabolic and endogenous losses. The ADMD and TDMD results of UTMSM, on the other hand, showed that 48 hr period was adequate for complete recovery of faecal material. This finding agreed with the time for total collection in the determination of bioavailable energy for this ingredient. Thus, digestibility study may be considered as one criterion to effectively determine period of complete passage of feed residues in the intestine on poultry.

Table 3: **Digestibility percentage of protein and dry matter contained in untoasted melon seedmeal (UTMSM) at different faecal collection periods**

Collection periods (hr)	APD	TPD	ADMD	TDMs
24	$63.22^{a}\pm1.87$	$79.24^{a}\pm1.66$	$67.39^{a}\pm1.10$	$77.49^{a}\pm0.09$
48	$46.49^{b}\pm2.24$	$76.87^{b}\pm2.08$	$54.39^{b}\pm1.62$	$73.14^{b}\pm1.44$
60	$41.46^{c}\pm2.30$	$75.97^{b}\pm2.14$	$50.28^{c}\pm1.75$	$72.67^{b}\pm1.44$

^{a,b,c,d}, Means within the column not bearingthe same superscript are significantly ($P<0.05$) different

Table 4: **Digestibility percentage of protein and dry matter contained in toasted melon seedmeal (TMSM) at different faecal collection periods**

Collection periods (hr)	APD	TPD	ADMD	TDMs
24	$62.81^{a}\pm3.04$	$77.07^{a}\pm2.38$	$61.51^{a}\pm1.08$	$78.69^{a}\pm1.00$
48	$45.11^{b}\pm3.88$	$73.36^{b}\pm3.24$	$51.35^{b}\pm1.12$	$68.65^{b}\pm1.03$
60	$40.84^{c}\pm4.07$	$74.61^{b}\pm3.24$	$46.78^{c}\pm1.29$	$67.94^{b}\pm1.29$

$^{a,b,c,d.}$ Means within the column not bearing the same superscripts are significantly ($P<0.05$) different

The observed results of APD and TPD of TMSM tended to suggest that collection period beyond 48 hr was needed for complete recovery of faecal material. This observation agreed with that obtained in the calculation of AME. Comparision between UTMSM and TMSM showed that there is no difference in their APD and TPD as well as their ADMD (Tables 3 and 4), thus indicating that toasting melon seeds has no effect in nutrient availabilty and digestibility by birds in this study.

CONCLUSIONS AND APPLICATION

1. Apparent digestibilty was lower than the true digestibility estimates after correction.

2. Also, correction of apparent metabolic energy to true metabolic energy of the feedstuffs lowered their apparent metabolic energy values.

3 Apparent digestibility and apparent metabolisable energy of both UTMSM and TMSM were affected by period of faecal collection.

4. Digestibility study may be used to determine period of complete passage of feed residues in the intestine of chickens.

5 Corrections made for apparent digestibility and bioavailable energy values were necessary to enhance greater precision of data obtained.

REFERENCES

1. Sibbald, I. R. 1982. Measurement of bioavailable energy in poultry feeding stuffs. A review Can. J. Anim. Sci 62: 983-1048

2 Blair, B., J Gagnon, R. E. Salmon and M.D. Pickcard. 1986. Evaluation of spent bleaching clay as a feed supplement in layers diets. Poultry Sci. 65: 1990-1992.

3 Dafwang, I. I., M. E. Cook, D. G. Pringle and M. L. Sunde , 1986 . Nutritional value of aerobically fermented poultry manure and offal (Fermway) for broiler chickens. Poultry Sci. 65: 1765-1770.

4 Atuahene, C. C. , A. Donkoh and H. Swatson. 1987. Oil palm slurry (OPS) as a partial replacement for maize in the diets of broiler chickens Anim. Feed Sci Technol 17: 157-162

5 Atteh, J. O. and F. D. Ologbenla, 1993. Replacement of fishmeal with maggots in broiler diets: effect on performance and nutrient utilisation. Nig. J Anim. Prod. 20: 44-49.

6 Sibbald, I. R. and M. S. Wolynetz. 1985. Relationships between estimates of bioavailable energy made with adult cockerels and chicks: effect of feed intake and nitrogen retention. Poultry Sci. 64: 127-138).

7 Nwokolo, E. and J. S. Sim. 1987. Nutritional assessment of defatted oil meals of melon *Colocynthis citrullus,* L) and fluted pumpkin *Telefaria occidentallis,* H) by chick assay J. Sci. food Agric 38: 237-246

8 Oyolu, C. 1977. A quantitative and qualitative study of seed type in egusi (*Colocynthis Citrullus,* L) Trop. Sci 19:55-62

9 Oruwari, B. M., B.T. Sese and O.O Mgbere (1996). Whole Palm Kernel in diets for broilers. Bull. Anim. Hlth., Prod. Afri 44: 179-183.

10 Gill I. J. 1978. Design and Analysis in Animal and Medical Sciences. 1st Ed. Vol. 3. Iowa State University Press, Ames, Iowa, USA.

11 AOAC. 1990. Association of Official Analytical Chemists. Official Methods of Analysis . 15th Ed . Arington. VA, USA. DC

12 Sibbald, I. R. 1986 . The effect of feed of input and excreta collection time on estimates of metabolic plus endogenous energy losses in the bioassay for true metabolisable energy. Poultry Sci. 62: 68-76.

13. Kessler, J. W and O. P. Thomas 1981. The effect of cecectomy and extension of the collection period soyabean meal, feather meal, fishmeal, and bloodmeal. Poultry Sci. 60:2639-2647.

14 Schneider, B. H. and W. P. Flatt. 1975. The Evaluation of feed Through Digestibility Experiments. The University of Georgia Press Athens pp. 147.

15 Sibbald I. R. and J. K. G. Krammar 1980. The effect of the basal diet on the utilization of fats as a source true metabolisable energy, Lipids and fatty acids. Poultry Sci. 59:316- 3247.

16 Muztar, A. J. and S. J. Slinger. 1980. Effect of length of collection period on the metabolisable energy value in short term assays. Nutr. Rep. Int. 22: 589-595

17 Hedge. D. M. and G. N. Kulkarni. 1976. Factors Affecting the chemical composition of the Plants. Vikas Publ. House PVT Ltd. New Delhi. pp. 82

18 Oyenuga, V. A. 1968. Nigerian foods and feeding stuffs: Their chemistry and nutritive values, pp 75-79. 3rd Ed. Ibadan University Press. Ibadan.