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DETERMINATION OF ENERGY VALUES OF LOCALLY PRODUCED PALM KERNEL AND COCONUT MEAL IN GROWING POULTRY CHICKS

F.A.S DAIRO, [1]B.K OGUNMODEDE, G.O OHIKHUARE AND O. OTENIYA

Department of Animal Production & Fisheries,
Lagos State Polytechnic, Ikorodu, Nigeria.
[1]Department of Animal Science, University of Ibadan, Ibadan, Nigeria.

Target Audience: Nutritionist, poultry farmers, researchers.

ABSTRACT

Fifty-four Warren Cockerels at four weeks of age were used for the energy evaluation of locally processed coconut meal and palm kernel meal (PKM). The birds were housed in an adapted layer cage, supplied with feed and water for a period of 21 days. The reference diet (Diet 1) contained 210.20gkg|-1| crude protein. The PKM and coconut meal were used to replace 30% of the reference diet which constitute diets II and III respectively. The apparent metabolizable energy (AME) nitrogen corrected apparent metabolizable energy (AME_n), true metabolizable energy (TME) and the nitrogen corrected true metabolizable energy (TME_n) were monitored. Birds on the coconut meal diet recorded 12.55 $MJKg^{-1}$ AME, 11.10 $MJKG^{-1}$ AME_n, 12.50 $MJKg^{-1}$ TME, 11.36 $MJKg^{-1}$ TME_n which were significantly (P<0.01) higher than 12.21 $MJKg^{-1}$ AME; 9.97 $MJKg^{-1}$ AME_n 11.22 $MJKg^{-1}$ TME, and 10.01 $MJKg^{-1}$ TMEn of the PKM. The obtained values of AME and TME were almost the same for the coconut meal and PKM. The AME, AME, TME and TMEn correlate positively with dietary levels of fat. The coefficient of determination R = 0.95; 0.93; 0.88; and 0.91 respectively for the listed parameters

Keywords: Coconut meal, palm kernel meal, AME, TME

DESCRIPTION OF PROBLEMS

Metabolizable energy (ME) is an important practical means of evaluating dietary energy available for maintenance and production activities especially in farm animals. It is of economic importance as the cost of energy is about 70% of the feed cost and about 40% of the poultry production cost (1) The ME, of most feedstuffs can be determined either through their chemical composition and or prediction equations(2;3).These have been found inappropriate due to variations in digestibilities of the component which obviously varies even withn species. Fischer and McNab (4) indicated M E to be more of animal dependent for evaluation rather than the feedstuff chemical characteristics only. Processing methods, meal form, the rate of inclusion (ROI) and feed passage in the intestine were also reported to be a determining and prediction factors for the ME utilization of the oil bearing feedstuff (5, 3, 6, 7).

Availability of wide range of differently and locally processed palm kernel and coconut oil often lead to overestimation or understimation of the biovailable energy of metabolizable energy of the feedstuff for ration formulation in Nigerian. It becomes necessary therefore to evaluate the energy for the locally processed PKM and coconut oil meal.

MATERIALS AND METHODS

Coconut meal and palm kernel meal were collected from the small scale producers involved in the oil extraction locally in the Lagos State of Nigeria.

Processing Method of the Test Ingredients

i. Palm Kernel Meal

Palm kernel meal used in this study was processed mechanically using the extrusion method which is commonly employed by the producers in Nigeria.

ii. Coconutmeal

The coconut meal was obtained by the wet processing methods. The local producers employed the solvent extraction system after the coconut meal had been grated. It was thoroughly washed several times and filtered through a cloth mesh. The oil and water mixture and some residue of the coconut meal were cooked during which vapourization tooks place and the oil and other residue were allowed to cool. The left-over after the wash was collected and used for this study. As at the time of writing this report , this is the conventional processing method by the villagers as most of the mechanized processors are not functional. The collected left-over was sundried on a flat plastered platform to about 10% moisture content. Samples of the PKM and coconut meal and the basal diet were then analysed for proximate composition (8).

EXPERIMENTAL PROCEDURE

Warren cockerels raised on commercial chicks starter diet containing 200.3kg crude protein and 12.18 MJKg ME were used for the study. At four weeks old, fifty-four Warren cockerels of weight range 0.453 - 0.462 were allotted randomly to three groups of eighteen birds per group. Each group was replicate. The birds were housed in an adapted layer cage for metabolic study for a period of 21 days.

A reference diet containing 210.20g kg crude protein was fed to the birds. The reference diet containing (Kg) 550.00 maize, 80.00 brewers dried grain;

150.00 soybean cake; 75.00 corn offal; 85.00 blood meal; 30.00 bone meal, 20.00 oyster shell, 5.00 methionine, 2.50 each for salt and premix, The test feedstuff (PKM and coconut meal) were used to replace the reference diet at 30% by weight respectively. The reference diet was fed up to group (one) while the diet containing 30% PKM was fed to group two and 30% coconut meal was fed to group three. All the birds were fed for a period of 14 days to get adjusted to the cage and the feed. On the 17th day, two birds each (already in cages) per group were starved for 24 hours after which the faeces were collected for the metabolic waste determination. At the beginning of the last three days weighed quantity of feed were fed with generous supply of fresh and cool water. The collection of faeces was done using the remaining birds employing the total collection procedure.

The faecal collecton were dried in a Gallenkamp forced draught air-oven at 60°c for 3 days. The dried faecal samples were miled in a christy and Noris Portable Laboratory Mill and kept in an air-tight glass specimen bottle from where little quantities were withdrawn for the determination of nitrogen (8).

The gross energy (GE) of the reference diet, test feedstuff and dried faeces were determined using the Gallenkamp ballistic bomb calorimeter. The AME and TME were calculated (9) and were corrected for nitrogen (10)

The data obtained were subjected to the analysis of variance and linear regression.. The AME and TME of test ingredients were compared using the t-test. The Duncan Multiple Range Test (11) was employed to separate the means (12).

RESULTS AND DISCUSSION

The proximate composition of the reference diet, PKM and Coconut meal are present in Table 1. The ether extract content of the coconut oil meal was higher than the PKM. The gross energy content of the reference diet and the test ingredients are also indicated in Table 2. The feed intake endogenous faecal output and gross energy of faeces were not significantly influenced (P>0.01) even though a single level assay method was used for the two test ingredients. The faecal output and gross energy of the feed were also significantly (P>0.01) affected. The gross energy consumed, gross energy retained, the apparent metabolizable energy (AME), nitrogen corrected apparent metholizable energy (AMEn), t rue metabolizable energy (TME) and the nitrogen corrected true metabolizable energy (TMEn) were all highly affected significantly (P<0.01).

Table 1 Determined Chemical compostion and gross energy of basal and test ingredients.

Parameters	Dietary Group			Test Ingredients	
	I	II	III		
	Basal	Basal + PKM	Basal+ Coconut meal	Palm Kernel meal	Coconut meal
Dry Matter	973.41	948.50	984.71	918.30	889.30
Crude protein	210.20	193.76	203.68	200.40	196.10
Ether Extract	38.30	88.39	109.20	88.30	167.20
Crude Fibre	40.70	71.27	98.42	154.70	180.00
Gross Energy $MJKg^{-1}$	17.05	17.86	20.26	17.10	18.92

Table 2: Feed intake, faecal output and their gross energy

Parameters	Dietary Group			SEM
	I basal	II basal+ 30%PKM	III basal 30%+ coconut meal	
Feed Intake (Kg)	0.173	0.141	0.153	3.2×10^{-4}n.s
Faecal Output (kg)	0.042^{b}	0.37^{c}	0.05^{a}	3.83×10^{-5}
Endogenous Faecal Output (kg)	0.006	.008	.009	5.7×10^{-4}
Gross Energy of Feed ($MJkg^{-1}$)	17.05^{b}	17.86^{b}	20.26^{a}	0.30 s
Gross Energy of faeces ($MJkg^{-1}$)	12.21	13.76	12.94	0.92 ns

Mean values with different superscript on same row differ significantly ($P<0.01$)
ns = not significant
s = significant

Expectedly as indicated in Table 2; the gross energy of the coconut meal was the highest and birds in group three consumed more energy than the others . The energy retained, AME, AMEn, TME, and TMEn followed the same trend (Table 3) even though the feed intake were not significantly influenced ($P>0.01$). The residual oil of the PKM, $88.30gkg^{-1}$ was lower than that of the coconut meal of 167.20gkg-1 which must be contributory to the overall estimated values of each of the test ingredients.

The fatty acids in the test ingredients are similar in composition (13). The expectation therefore is a very close values for their AME. However, the

AME value of 11.69MJKg-1 for PKM and 12.55 MJKg-1 for the coconut meal must have been influenced by the fat levels in the respective test ingredients (14). The prediction equations of many workers were based on the chemical compositions of the test diets with adequate consideration for the fat levels and the fatty acid compositions when regressed (15, 3, 14) The variations in the processing and the analytical techniques have profound influence on the AME and AMEn values (16). This may affect the utilization of the nutrient and energy in different manners. Whilst the result in this study indicated positive correlations with the dietary fat levels as reflected by the values of the respective coefficient of determintion a contrary observation was reported (6) for rubber kernels. The AME and AMEn for PKM is crude fibre of a feed, the associated fat contents and the rate of passage in the intestine (5). Test ingredients or feeds that are highly fibrous with high possibility of incomplete clearance often lead to a higher estimate of AME and AMEn values is perhaps due to the variation in the crude fibre contents.

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Table 3: The gross energy consumed and retained, apparent metabolizable energy, true metabolizable energy and their corresponding nitrogen corrected values for the reference diet, PKM and coconut oil meal

Parameters	Dietary Group			SEM	Regression	Coefficient of
	I	II	III		Equation	determination
	Basal	Basal + 30% PKM	Basal + 30% Coconut Oil meal		Y= a + bx	R (P<0.01)
Gross Energy	2.45^{b}	2.10^{c}	2.76^{a}	0.008	-	-
Gross Energy Retained	1.93^{a}	1.47^{b}	1.94^{a}	0.007	-	-
Apparent Metabolizable Energy (AME)	11.69^{b}	11.21^{b}	12.55^{a}	0.093	1.17+0.0062x0.95	
Nitrogen Corrected Apparent Metabolizable Energy (AME)	9.78^{b}	9.97^{b}	11.10^{a}	0.01	9.34+0.009x	0.93
True metabolizable Energy (TMEn)	11.77^{b}	11.22^{b}	12.50^{a}	0.094	11.31+0.005x	0.88
Nitrogen Corrected True Metabolizable Energy (TMEn)	9.83^{c}	10.01^{b}	11.36^{a}	0.16	9.14+012x	0.91

Means with different superscript on the same row differ significantly (P<0.01) the coconut meal must have overshadowed this effect. The AME values obtained for coconut meal in this study is lower than those reported . (3) but higher than those obtained (17,18).

The TME and TMEn estimates almost ranked same for AME and AMEn. The nitrogen corrected valus of the AME and TME were significantly (P<0.01) lower correspondingly using the t-test .

Table 4 Metabolizable energy and true metabolizable energy of basal and test diets ($MJKg^{-1}$)

	M.E	TME	S.E	MEn	TMEn	S.E
Basal	16.69[a]	11.77[b]	0.33	9.91[a]	9.76[b]	0.15
Basal + Coconut meal	12.55[a]	12.50[b]	0.11	11.10[a]	11.36[b]	0.03
Basal + PKM	11.2[a]	11.2[b]	0.17	9.17[a]	10.00[b]	0.21

Means on the same row with same superscript differ significantly (P<0.01)

The birds used for this study were about four weeks old. The age effect on the utilization of some of the nutrients had been established (19, 20). Since the birds are still growing some of the nitrogen or substantial part of the nitrogen must have been lost as component of uric acid. Quite a number of factors affect these values such as intake, fatness of the fasted birds, palability of diets among others already mentioned. However in this study the experimental birds were chosen such that a difference of 0.009 g was the maximum in weight variation.

The AME and TME of the locally processed coconut meal indicated superioty as energy source over the PKM. The coconut meal can therefore be used as dual purpose ingredient firstly as calorie source and secondly as a vegetable protein source in poultry ration if the amino acid deficiency in it are adequately balanced.

CONCLUSION

The conclusion from this study indicate that the AME of the locally processed PKM and coconut meal are 11.21 $MJKg^{-1}$ and 12.55 $MJKg^{-1}$ respectively. Coconut meal has the advantageous implication of its use as a dual purpose ingredients namely as calorie and vegetable protein source over the PKM in poultry ration.

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