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Short Communication

Nutritional evaluation of palm kernel meal types: 1. Proximate composition and metabolizable energy values

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Studies were conducted to determine the proximate composition and metabolizable energy values of palm kernel meal (PKM) types. The PKM types studied were obtained from Okomu, Presco and Envoy Oil Mills and were either mechanically or solvent extracted using different varieties of palm kernels. Samples of PKM types were assayed for proximate composition and the results obtained indicated that Okomu, Presco and Envoy PKM resulted in crude protein values of 14.50, 16.60 and 19.24%, respectively. Crude fibre values were in the order of 10.00, 12.29 and 17.96%, respectively for Okomu, Presco and Envoy PKM types. Envoy PKM resulted in the lowest fat content (1.30%) while Okomu and Presco PKM gave fat values of 9.48 and 7.59%, respectively. The values of ash ranged from 3.40 to 4.34% and nitrogen free extract, 50.05 to 53.42%. Apparent metabolizable crude energy values were 2654, 2423 and 1817 for Okomu, Presco and Envoy PKM, respectively. It can be concluded that Okomu and Presco PKM which were mechanically extracted had close nutrient values and were particularly higher in fat but lower in protein as compared to Envoy PKM.

Key words: Nutritional evaluation, palm kernel mean, proximate composition, metabolizable energy.

INTRODUCTION

Experience has shown that a wide range of palm kernel meal (PKM) types exist depending on the processing method and type of palm kernel used. Over the years, PKM has been indiscriminately used in broiler chicken diets without due regard to type or source. This has given rise to inconsistent results and may be responsible for the low productivity of broiler chickens fed PKM-based diets. Attempts have been made to chemically characterize PKM without regard to type. Consequently, random chemical analyses have resulted in a wide range of nutrient values. For instance, PKM has been found to contain between 16.0 and 21.3% crude protein with low content of lysine, methionine, histidine and threonine (Nwokolo et al., 1977; Olomu, 1995). The crude fibre content ranges from 6.7% (Babatunde et al., 1975) to 17.5% (Olomu, 1995). It has an estimated ash content of 4.30% (Yeong, 1980; NIFOR, 1995). The values of ether extract range between 0.80% (Yeong et al., 1981) and 10.33% (Nowkolo et al., 1977; Onwudike, 1986; Olomu, 1995). The nitrogen free extract ranges between 38.7% (Olomu, 1995) and 63.5% (Yeong et al., 1981). The values of the metabolizable energy are in the range of 1481.8/kcal/kg (Nwokolo et al., 1977) to 2500.0/kcal/kg (Olomu, 1995).

An in-depth understanding of the nutro-chemical characteristics of PKM types would ensure a more judicious use of the feedstuff. In addition, it would go a long way to standardizing research results in relation to specific types of PKM.

MATERIALS AND METHODS

Source of test materials

In this study, three types of PKM were tested. The first type was obtained from Okomu Oil Palm Company Plc, Benin City. The varieties of palm kernel used here are dura and tenera. After mechanical cracking of the nuts, the kernels are separated from the shells with the aid of kaolin solution. The processing method adopted in the extraction of palm kernel oil is mechanical method. The second source of PKM is Presco Oil Plc, Benin City. Here, already process-

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Table 1. Percentage composition of basal diet.

Ingredients	Basal diet (no PKM)
Maize	65.00
Palm Kernel Meal	00.00
Soyabean meal	28.00
Wheat offal	3.00
Bone meal	2.00
Oyster shell	1.00
Salt	0.30
Premix[1]	0.50
Methionine	0.10
Lysine	0.10
Cost/kg diet (₦)	50.22
Calculated composition	
C.P (%)	20.00
ME (Kcal/kg)	3000.0
Calorie : Protein	150.00
Crude fibre (%)	2.83
Total Phosphorus (%)	0.70
Calcium (%)	0.65
Lysine (%)	1.22
Methionine + Cystine (%)	0.60

[1]Supplied per kg diet: Vit. A, 6500 I.C.U.; Vit D_3, 1300 I.C.U.; Vit E, 2.44 I.C.U.; Vit K, 1.625 mg; Vit B_1, 0. 8125 mg; Vit B_2, 2.44 mg; Vit B_3, 7.313 mg; Vit B_6,0.8125 mg; Vit B_{12}, 0.0065 mg; Calcium pantothenate, 3.66 mg; Folic acid, 0.406 mg; Manganese, 56.88 mg; Zinc , 40.625 mg; Iron, 16.2 mg; Copper, 2.44 mg; Iodine, 0.8125 mg; Cobalt, 0.1625 mg; Selenium, 0.08125 mg; Choline chloride, 0.1625 mg; Methionine, 1.79 g; Lysine, 1.83 g; Anti-oxidant, 0.08125 mg; Anti-mould, 12.1875 mg; Growth promoter, 0.01625 mg; Carrier, add 2.03 mg;12.1875 mg; Growth promoter, 0.01625 mg; Carrier, add 2.03 mg; Methionine, 1.79 g; Lysine, 1.83 g.

Table 2. Proximate composition and metabolizable energy values of different types of palm kernel meal.

Parameter	Palm kernel meal type		
	Okomu	Presco	Envoy
Moisture content (%)	8.26	8.25	8.05
Crude protein (%)	14.50	16.60	19.24
Crude fibre (%)	10.00	12.29	17.96
Crude fat (%)	9.48	7.59	1.30
Ash (%)	4.34	3.88	3.40
Nitrogen free extract (%)	53.42	51.39	50.05
AME (kcal/kg)	2654	2423	1817
AME_n (kcal/kg)	2599	2367	1784

cessed palm kernels obtained from different sources are used suggesting that the method of processing to get the palm kernels and type of kernel are not known. Palm kernel oil extraction is also carried out mechanically. The third source of PKM is Envoy Oil Mill Plc, Port Harcourt. Here, already processed palm kernels are procured from different sources. The palm kernel oil is extracted using hexane base (or solvent extraction method).

Proximate analysis

To determine the proximate composition, representative samples of differently processed PKM were assayed for moisture, crude protein, crude fibre, fat and ash. Nitrogen free extracted was computed accordingly (A.O.A.C., 2001).

Metabolizable energy study

The ME values were determined using five weeks old Hybro broiler chickens. At the beginning of the studies, the birds were divided into 12 similar groups at three birds per group. Three groups were randomly placed on each of the 4 diets used in the Experiment. A standard broiler diet, without any of the test ingredients served as the control or basal diet (Diet 1, Table 1). In diets 2, 3 and 4, Okomu, Presco and Envoy PKM was substituted at 20% into the control diet. That is, each of the test diets constituted 80% basal and 20% test ingredient. The treatments were thus:

Treatment 1 – control (or basal) diet, without PKM (Diet 1)
Treatment 2 – 80% basal + 20% Okomu PKM
Treatment 3 – 80% basal + 20% Presco PKM
Treatment 4 – 80% basal + 20% Envoy PKM

The apparent metabolizable energy (AME) of the basal diet and the substituted diets were calculated using algebraic equation:

$$AME = [(Fi \times GE_f) - (E \times GE_e)] / F_i$$

Where F_i = Feed intake (g), E = Excreta output (g), GE_f = Gross energy of feed (Kcal/kg), and GE_e = Gross energy excreta (Kcal/kg). From the ME of the basal and substituted diets, the ME of the test ingredients was calculated using the following assumptions and algebraic equation:

If the ME of basal diet (x) = a kcal/kg and

That of the 80% basal + 20% ingredient (y) = b kcal/kg

Then 100x = a kcal/kg

x = a/100 kcal/kg

0.8x + 0.2y = b kcal/kg

0.20y = b - 0.8x kcal/kg

y= (b-0.80x)/0.20 kcal/kg

RESULTS AND DISCUSSION

The proximate composition of the PKM types is presented in Table 2. The results indicated that none of the PKM samples had crude protein up to 20%. The crude protein content obtained fro Okomu, Presco and Envoy PKM types were 14.50, 16.60 and 19.24%, respectively. Envoy PKM resulted in the highest crude fibre value (17.96%). Okomu and Presco PKM gave fibre values of 10.00 and 12.29% respectively. The crude fat content varied between 1.3% (Envoy PKM) and 9.48% (Okomu PKM). Percentage ash content of PKM was in the range of 3.40 to 4.34%. Percentage nitrogen free extract of the PKM types ranged between 50.05 and 53.43%.

The results of the metabolizable energy study are presented in Table 2. The results showed that Okomu PKM gave the highest AME value of 2654 kcal/kg (11.11 MJ/kg) while Envoy PKM gave the lowest value of 1817 kcal/kg (7.60 MJ/kg). Presco PKM gave a value intermediate between those of Okomu and Envoy PKM, 2423 kcal/kg (10.14 MJ/kg). The n-corrected apparent metabolizable energy (AME_n) followed the same trend as AME.

The results of the proximate chemical analysis of PKM types indicated that the crude protein values range between 14 and 20%. The variation in crude protein composition can be attributed to differences in processing method employed and type of palm kernel used. The results showed that Envoy PKM which is solvent extracted gave the highest value of crude protein as compared to Okomu and Presco PKM. This is definitely due to greater concentration of the nutrient because of the lower amount of fat left after the solvent extraction process. The crude fibre values observed were higher than that earlier reported by Babatunde et al. (1975). The crude fibre value reported by Olomu (1995) was within the range of values observed in this study. The wide range of crude fibre values may be related to the type of palm kernel used, method of separating shell from the kernel, the amount of shell left in the kernel before oil extraction and the method of processing of the palm kernel before use. The solvent extracted PKM yielded higher crude fibre than the mechanically extracted PKM. This may be related to the higher degree of oil extraction associated with the solvent extraction method. Okomu and Presco PKM resulted in fat contents of 7.59 and 9.48% which were comparable; suggesting that mechanically processed PKM has a fat content ranging between 8 and 9% which agreed with the findings of Palmer-Jones and Halliday (1971). The low fat level (1.3%) recorded for Envoy PKM (solvent extracted PKM) also agreed with earlier reports (Palmer-Jones and Halliday, 1971; Yeong et al., 1981). The lower value is due to the fact that solvent extraction usually removes more fat from the products than mechanical extraction. The values of ash content observed were within the reported range of values (Yeong, 1980; Onwudike, 1986; NIFOR 1995). The NFE values reported were in agreement with earlier reports (Yeong et al., 1981).

The results of the metabolizable energy studies showed that Okomu and Presco PKM which were mechanically processed resulted in higher metabolizable energy than the Envoy PKM which was solvent extracted. This may be related to the processing method employed in the production of the PKM types. Mechanical extraction resulted in higher residual oil (about 8%) in the cake than the solvent extraction process which resulted in about 1% residual oil. It is not surprising therefore, that Okomu and Presco PKM resulted in higher ME values than the Envoy PKM. The ME values obtained for Okomu and Presco PKM are close to the value earlier reported (Olomu, 1995).

Conclusion

From the results of the foregoing studies, it can be concluded that Okomu and Presco PKM which were mechanically processed resulted in almost similar values of proximate composition and metabolizable energy which were distinct from the values obtained for Envoy PKM (solvent extracted PKM).

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