Utilization of varying levels of palm kernel cake by Nigerian local chicks *(Gallus domesticus)*

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Abstract
Palm Kernel Cake (PKC), a residue and by-product of oil extraction of palm kernel is abundant in Nigeria, non-toxic and readily available at low cost. The objective of this study was to evaluate the use of PKC at varying levels in the diets of Nigerian local chicks. Sixty four day old local chicks were randomly allotted to four experimental diets of four birds per replicate of four on a partitioned deep liter house for nine weeks. The PKC levels used were 0% (which serves as control), 10%, 15%, and 20%. All diets were formulated to be isonitrogenous (22%CP) and isocaloric (3000kcalME/kg). Feed intake was recorded daily, and weekly records of live weight were taken. Results showed that daily feed intake, final body weight, weight gain and feed conversion ratio (FCR) were not significantly ($p > 0.05$) different or affected by any level of PKC used, though numerical differences among treatment means were observed. Cost of feed per kg decreased with increase in PKC level. Cost of feed per kg gain decreased from the control diet (₦457.16) to diet 4 (₦381.90) except for diet 3 whose value (₦377.57) was the lowest. It was concluded that PKC may be used up to 20% level in a maize-soybean meal based diet for Nigerian local chicks without any adverse effect on their performance and economy of production.

Key words: Palm Kernel cake, local chicks, non-toxic, isonitrogenous utilization

Introduction

To meet the ever-increasing demand for protein from poultry meat in Nigeria, commercial poultry sector need to be sustained. The sustainability need to revolve round all species of poultry that can thrive or survive the prevailing climate, hence local breeds need not be left out.

The Nigerian local chicken constitute about 92% of the total poultry population in Nigeria (Akinwumi *et al* 1979), about 103 Million in number (RIMS, 1993) and the number has been decreasing with years as a result of the increase in the number of imported/exotic breeds whose performance could not be sustained over many generations.

The Nigerian local fowl has been described as largely genetically uncharacterized, unimproved and raised under no or low input extensive system or free range (Oluyemi and Robert, 2000, yet they are well adapted to the tropical environment and are highly valued culturally, spiritually and historically.

Performances of local fowls have been shown to be improved by restricted feeding and cross-breeding (Oluyemi, 1974), thus meeting the nutritional needs and taste of Nigerians. In addition to these, the nutritional requirements of local fowls at chick starter and finisher stages have been determined (Ezeokeke, 2004) and can be a baseline or stratum on which their performance can be improved upon at a lower cost of input using the locally available resources.

Palm kernel cake (PKC) is a by product of hydraulic press oil extraction of palm kernel at vegetable oil industry which is readily available at a cheaper rate (₦8 – ₦12 in Nigeria) not toxic, moderately rich in protein (9.7 – 21%) and metabolizable energy of between 1,479 to 2260.94kcal ME/kg (Nehring and Nehring 1969, Perez *et al*, 2000, Onifade and Babatunde, 1998, Chin, 2002 and Sundu *et al.*, 2006).

PKC has no anti-nutritional properties, aflatoxin free, palatable and has considerable potential as a source of carbohydrate and protein in livestock feed. PKC has been reported to have low nutritive value, grittiness and potential for deterioration in unhygienic conditions (Sundu *et al.* 2006) and its oil quickly goes rancid to lose its taste.

The objective of this study was to find out and compare the feed intake, weight gain, efficiency of feed utilization, feed conversion ratio (FCR) and cost of feed (₦) per kilogramme weight gain among local starter chicks fed varying levels of PKC in their diets.

Materials and methods

Palm kernel cake, a by-product of palm kernel oil extraction for this study was purchased from a local feed miller in Ibadan. Three diets were formulated with varying levels (i.e. 10%, 15% and 20%) of PKC, which was used to replace maize and soybean simultaneously in diets II, III, and IV respectively. A control diet (Diet I) with 0% PKC was allowed. The four diets were isonitrogenous and isocaloric containing 22% crude protein (CP) and Metabolizable Energy (ME) of 3000 kcal/kg of feed (Ezeokeke, 2004). The percentage composition of experimental diets and their respective calculated analyses were shown in Table 1.

Sixty four (64) day old local chicks with initial mean body weight of 26.69g/chick were allotted to four experimental diets with four birds per replicate of four on a partitioned deep litter house at the Teaching and Research Farm, University of Ibadan, Ibadan, Nigeria.

The experimental design was a completely Randomised Design (CRD) with the statistical model:

$$\gamma ij = \mu + Tj + \square ij$$

Where

γij = individual observation (of jth treatment in ith animals),

μ = general mean (i.e. population of all possible similar experiments),

Tj = effects of the jth (PKC inclusion) treatment,

and $\square ij$ = experimental error containing all uncontrolled sources of variation.

All birds were given feed and water *ad libitum* for nine weeks. Normal vaccination and medication programmes for birds were observed. Daily record of feed intake and weekly records of live weight and weight gain of birds were taken throughout the nine weeks of the experiment. Costs of feed and cost of feed per kg weight gain were also determined.

Proximate composition and fibre fractions of experimental diets and test ingredient were determined by the method of AOAC (1990), and Van Soest *et al.*, (1991) respectively. Data collected were subjected to statistical analysis of variance (ANOVA) procedure of SAS (1999) and the means were compared by Duncan option of the same software package.

Table 1: Composition of experimental diets with varying levels of PKC fed to local chicks (0 – 9 weeks).

Ingredient	Diet 1 0% PKC	Diet 2 10% PKC	Diet 3 15% PKC	Diet 4 20% PKC
Maize	60	53	48.5	45.50
Soybean meal	29.91	26.91	26.41	24.41
PKC	-	10	15	20
Fish meal (72%)	5.0	5.0	5.0	5.0
Palm oil	2.0	2.0	2.0	2.0
Bone meal	2.1	2.1	2.1	2.1
Oyster shell	0.50	0.50	0.50	0.50
* Premix (chicks)	0.25	0.25	0.25	0.25
Salt	0.18	0.18	0.18	0.18
Lysine	0.01	0.01	0.01	0.01
Methionine	0.05	0.05	0.05	0.05
Calculated analyses:				
Crude Protein (%)	22.16	22.00	22.24	22.00
Metabolizable Energy (Kcal/kg)	3170.97	3067.09	3007.86	2959.54
Crude fibre (%)	3.19	4.06	4.54	4.94
Calcium (%)	1.32	1.34	1.35	1.35
Phosphorus (%)	0.70	0.69	0.69	0.68
Methionine (%)	0.43	0.44	0.44	0.45
Lysine (%)	1.22	1.18	1.19	1.16
Cost (₦)/kg	59.29	55.54	53.92	51.92

* Supplied per kg diet: Vit. A, 12,500000 I.U., Vit. D_3, 2500000 I.U., Vit. E, 40g., Vit K_3 2g., Vit. B_1 3g., Vit. B_2, 5.5g., Niacin, 55g., Calcium panthothnate 11.5g., Vit. B_6, 5g., Vit. B_{12} 25mg., Choline chloride 500g., Folic Acid 1g., Biotin 80g., Copper 8.5g., Iodine 1.5g., Cobalt 300mg., Selenium 120mg., Antioxidant 120g.

Results and discussion

The proximate composition and fibre fractions of experimental diets and PKC used were shown in Table 2. It revealed that PKC contains crude protein, crude fibre, ether extract, ash, nitrogen free extract, neural detergent fibre and lignin content of 16.6%, 25.3%, 12.5%, 10.1%, 35.5%, 48.6% and 8.5% respectively.

These values were within the range used in previous studies but with slight variation in ash and a remarkable increase in crude fibre level, which would be expected when working with by products of such origin. PKC proximate composition will depend on variety, soil, method of extraction and the percentage kernel oil extracted. The determined crude protein content of 22% in the diets was adequate for the Nigerian local chicks (Ezeokeke 2004) and is a true reflection of the calculated CP values in Table 1. It was also observed that the crude fibre and lignin components of the experimental diets increased progressively from diet 1 (control) to diet 4 (Table 2) as the PKC level increased. The high crude fibre and lignin levels could be due to contamination by the nut shell or kernel during processing as this will increase the grittiness and fibrousness of the feed and will advantageously help chickens to grind the diet with a corresponding increase in the size of the gizzard (Onwudike, 1986).

Table 2: Proximate and detergent fibre composition of experimental diets and test ingredients (PKC)

Chemical Composition (%)	diet 1 0% PKC	Diet 2 10% PKC	Diet 3 15% PKC	Diet 4 20% PKC	Palm kernel cake
Dry Matter	83.90	86.0	85.1	83.60	85.10
Crude Protein	22.40	22.30	22.20	22.30	16.60
Crude Fibre	7.60	8.50	10.10	10.90	25.30
Ether extract	9.50	9.30	9.40	8.80	12.50
Ash	8.90	8.70	8.50	8.60	10.10
Nitrogen Free Extract (NFE)	51.60	51.20	49.80	49.40	35.50
Detergent fibre fractrion (%)					
Neutral Detergent Fibre (NDF)	18.30	18.20	18.10	18.00	48.60
Acid Detergent Fibre (ADF)	15.90	15.30	15.0	15.10	39.90
Aid Detergent Lignin (ADL)	2.50	3.60	4.10	4.90	8.50
Hemicellulose (HEMI)	2.40	2.90	3.10	2.90	8.70
Cellulose (CEL)	13.40	11.70	10.90	10.20	31.40
ADF: NDF	0.87	0.84	0.83	0.84	0.82
CEL:HEM	5.58	4.03	3.52	3.52	3.61

The performance characteristic of Nigerian local chicks fed varying levels of PKC is shown in Table 3.

Diet 1 (control) with 0% PKC recorded the highest mean daily feed intake of 29.86g/bird/day while the values obtained for other diets (2 – 4) containing 10% 15% and 20% PKC were lower (i.e. 24.92%, 25.31% and 26.22% respectively). Feed intakes across the diets were not significantly *(p > 0.05)* different.

The metabolizable energy and protein intake of chicks fed with control diet were significantly (P < 0.05) higher than those fed PKC – based diets and it decreased significantly as the PKC level increased from diet 1 to diet 4. The trend could be attributed to the quality of protein in terms of the amino acid content of the feed and the unavailability of the energy in fibre carbohydrates for enzymatic digestion and absorption in the birds digestive system. Onwudike (1986) had reported PKC to be deficient in some essential amino acids like lysine, methionine and leucine.

Table 3: Performance characteristics of Nigerian local chicks (0-9 weeks of Age) fed varying levels of PKC

Performance Character	Diet 1 0% PKC	Diet 2 10% PKC	Diet 3 15% PKC	Diet 4 20% PKC	SEM	Significance level
Daily feed intake (g/bird/9wks)	29.86	24.92	25.31	26.22	1.76	NS
Protein Intake (g/bird/day)	6.69^a	5.56^b	5.62^b	5.84^b	0.20	*
ME Intake (kcal/bird/day)	94.69^a	76.42^b	76.13^b	77.60^b	2.72	*
Final body weight (g/bird)	270.63	250.00	254.38	251.25	5.34	NS
Daily weight gain (g/bird/9wks)	3.87	3.55	3.61	3.56	0.08	NS
Feed conversion ratio (feed/gain/bird)	7.69	7.12	7.00	7.46	0.28	NS
Cost of feed (₦)/kg	59.29^a	55.54^b	53.92^c	51.92^d	0.54	*
Total cost of feed (₦)	111.52^a	88.43^b	85.96^b	85.77^b	3.23	*
Cost of feed/kg weight gain (N/kg)	456.09^a	395.31^b	377.30^c	387.32^c	15.35	*

* abcd Mean values along the same row with different superscripts are significantly ($p < 0.05$) different
NS = Not significant
* = Significant ($p < 0.05$)

The numerical decrease in feed intake observed could be attributed to the fibrousness of the diets containing PKC, which made it bulky and voluminous (i.e. with decrease in mass per unit volume). Beside this, is the limited expansibility of the GIT of young birds fed *ad libitum* (Nir *et al.*, 1993) and this would limit the amount of PKC (Table 3), though there were no significant differences *(p>0.05)* among these parameters. The control diet contain less feed the chicks can consume at a given period of time irrespective of the rate of passage in the gastro intestinal tract (GIT).

Birds on diet 1 with 0% PKC gave the highest numerical value for body weight (270.63g) and daily weight gain (3.87g/bird) which were higher than what obtained in other diets (2-4) containing fibre and might be more palatable than other diets, hence the higher feed intake.

. The feed conversion ratios (FCR) of the experimental diets which ranged from 7.00 to 7.71 were higher than the values (1.82 – 2.27) reported for exotic chickens by Onifade and Babatubnde (1998).

There were no significant *(p>0.05)* difference in the chicks mean body weight, weight gain and FCR even at 20% inclusion rate of PKC in their diets. Similar trend was observed by Perez *et al.*, (2000) who reported that feed consumption, FCR and egg weight were not significantly affected by the inclusion of PKC up to 40% in the diets of single comb white leghorn hens for twenty weeks. Orumuyi *et al* (2000) who fed graded levels of PKC (0, 10, 20, 30 and 40%) to grower rabbits reported that the values for daily feed intake, daily weight gain and feed efficiency compared favourably with those on control diet without PKC. The observed trend is in converse to what was obtained in previous studies with exotic birds (Onifade and Babtunde, 1998, and Ezieshi and Olomu, 2004) where feed intake, FCR and weight gain were significantly affected when PKC was fed above 15% rate of inclusion in the diets of broiler chicks.

The numerical decrease in weight gain, final body weight and FCR which were not statistically or significantly *(p > 0.05)* different indicates the superiority of maize-soybean meal to PKC and also suggest that PKC inclusion can be compared favourably with maize – soybean meal based control diet.

Cost of feed (₦) per kilogramme of feed based on the price of feed ingredients when the experiment was carried out decreases from the control diet without PKC (₦59.29) to diet 4 with 20% PKC (₦51.92). The same trend was recorded for the total cost of feed consumed, but cost of feed per kilogramme body weight gain for diet 4 (₦381.90) was greater than ₦377.57 observed in diet 3. Therefore to minimize cost and maximize profit, 15% level of inclusion of PKC will be more preferable to diet 4 with 20% PKC level.

Conclusion

Nigerian local chicks can utilize PKC up to 20% level of inclusion without adversely affecting their performance and economy of production.

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