The influence of graded level of palm kernel cake (pkc) on the performance of the layer fowl

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Abstract

The performance of layer fowls on diets containing graded levels of PKC was studied. One hundred and twenty white leghorn layer fowls were distributed over four treatments: Diet 1, Diet 2, Diet 3 and Diet 4, containing respectively 0, 8, 16 an 24 per cent of palm kernel cake. The layers were individually housed in metal cages and fed for 6 months. Average total number of eggs laid were 117.60, 120.70, 123.45 and 115.75, representing 72.60, 74.37, 76.21 and 74.17 per cent egg lay respectively for Diets 1, 2, 3 and 4. Corresponding average egg weight were 60.96 g, 58.12 g, 61.58 g and 59.06 g, and feed conversion efficiency was 2.63, 2.97,2.88 and 3.25 kg feed/kg egg for Diets 1, 2, 3, and 4, respectively. The corresponding cost of feed was 164.32, 161.47, 158.18 and 153.18 cedis per kg feed. It was considered that 16 per cent would be the optimum inclusion level for PKC in the diet of the layer fowl.

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Introduction

Maize and fishmeal which constitute the bulk of the energy and protein sources in poultry diets are very expensive now and unavailable at certain periods each year. Consequently, a great deal of attention has been turned towards evaluating alternative feedstuffs for poultry feeding. Palm kernel cake which is the by-product of oil extraction from the palm fruit is one such product. Although palm kernel cake is readily available in Ghana, it has not been used to any large extent as feedstuff for poultry, especially layers.

Palm kernel cake has variable composition, especially the oil level, depending on the processing conditions as shown from Table 1. Panigrahi & Powell (1991) found PKC from Sierra Leone contained 14.2 per cent CF and 9.7 MJ/kg ME whilst another from Malaysia had 21.0 per cent CF and 8.4 MJ/kg ME. The high crude fibre level would adversely affect the digestibility of the nutrients in PKC. Ogbonna *et al.* (1984) observed that the digestibility of both dry matter and gross energy decreased with increasing level of PKC in the diet. Both feed conversion efficiency and average body weight gain were depressed as the level of inclusion of PKC in broiler diets increased (Osei & Amo, 1986; Onwudike, 1986b; Panigrahi & Powell, 1991). Thus, it has been suggested that PKC inclusion in poultry diets should not exceed 20 per cent (McDonald *et al.*, 1982; Osei & Amo, 1986). Although 34 per cent PKC in the diet has been considered the highest level of inclusion in starter and grower diets for pullets (Onwudike, 1986a), no such studies have been conducted on PKC in the diets of layer fowls. This study was conducted, therefore, to evaluate the performance of layer fowls on diets containing graded levels of PKC.

Materials and methods

Animals, housing and management

The study involved 120 white leghorn layers of 32 weeks of age. The birds were wing-banded, weighed and randomly allotted to four treatment groups of 30 birds each. Each group was further divided into three replicates of 10 birds each. The birds were then housed individually in metal cages measuring 36 cm^2, each in an open-sided poultry house. Each of the experimental diets shown in Table 2 was fed to three lots of 10 birds per lot for 180 days, divided equally into six 28-day periods with an adjustment period of 12 days. Graded levels of PKC (0, 8, 16 and 24%) were included in the layer experimental diets. The experimental diets were formulated to be isonitrogenous, but differed in ME contents. Birds had free access to feed and water throughout the experimental period.

Chemical analysis

Proximate analyses of PKC and diets (dry matter, crude protein, ether extract, crude fibre and ash) were carried out using the standard procedures of AOAC (1990). The ME values of the experimental diets were, however, calculated from values given by the National Research Council (1994).

Parameters measured

Layer performance was assessed monthly, but the eggs were weighed weekly. Parameters studied include total eggs laid, percent egg production, average egg weight and feed conversion efficiency. Economics of production was based on the feed cost per kilogram of diet and unit cost of an egg weighing 60 g. Feed cost per kg for each of the experimental diets was estimated based on the prevailing market prices of the feed ingredients at the time of the trial. Feed cost per kg egg weight was also calculated for each dietary treatment.

Statistical analysis

Data on the performance criteria were analysed by the analysis of variance according to Snedecor & Cochram (1972). Means were separated using Duncan's multiple range test as outlined by Steel & Torrie (1960).

Results

The chemical analysis of PKC collected from four different locations in southern Ghana are shown in Table 1. The analyses showed a trend toward higher protein, crude fibre, ash and nitrogen-free-extract for PKC from the oil mills with a decrease in fat. The PKC from the cottage industries tended to have higher levels of ether extract.

Data on the performance of laying birds is summarised in Table 3. Although laying percent was not significantly different ($P > 0.05$) among the treatments, the layers on the 16 per cent PKC diet had the highest lay of 76.21 per cent. Layers on the PKC diets had slightly higher lay than those on the 0 per cent PKC diet (72.60%). The average total eggs laid were 117.6, 120.7, 123.5 and 115.8 for the layers on the 0, 8, 16 and 24 per cent PKC diets, respectively. These were not found to be significantly different ($P > 0.05$). The egg weight was 61.0 g, 58.1 g, 61.6 g and 59.1 g for the layers on the 0, 8, 16 and 24 per cent PKC diets. The egg weight on the 8 per cent PKC was significantly lower ($P < 0.05$) than that on the 16 per cent PKC diet. Feed conversion efficiency with the layers was 2.63, 2.97, 2.88 and 3.25 kg feed/kg egg for the 0, 8, 16 and 24 per cent PKC diets, respectively. These were found to be significantly different ($P < 0.05$) from each other. It deteriorated with increasing levels of PKC in the diet.

There was a progressive decrease in the unit cost of feed as the level of PKC in the diet increased. However, the feed cost per unit of egg produced increased with the includsion of PKC in the diet. The 16 per cent PKC produced the lowest cost per unit egg compared to the 8 and 24 per cent PKC diets.

TABLE 1

Proximate Composition of Palm Kernel Cake from Four Locations in Southern Ghana (%)

Location	*Process*	*DM*	*CF*	*Ash*	*EE*	*CP*	*NFE*
1	Cottage	53.9	18.2	2.93	10.5	12.2	10.1
2	Cottage	64.0	10.6	2.31	14.4	12.7	24.0
3	Oil Mill	94.2	19.6	3.87	10.8	19.0	40.9
4	Oil Mill	89.6	30.1	3.27	11.1	14.6	30.5

NB: DM = Dry matter; EE = Ether extract; CF = Crude fibre; CP = Crude protein; NFE = Non fibre extract.

Discussion

The nutrient composition of PKC has been shown in this study to be variable depending on the

TABLE 2

Composition and Nutrient Analysis of Layer Experimentatal Diets

	Levels of palm kernel cake (PKC) (g/kg)			
Ingredients	*0*	*8*	*16*	*20*
Maize	546.00	534.00	503.00	470.00
Wheat bran	200.00	142.00	100.00	63.00
Palm kernel cake (PKC)	0.00	80.00	160.00	240.00
Fishmeal	170.00	160.00	153.00	430.00
Oyster shell	80.00	80.00	80.00	80.00
Premix	1.50	1.50	1.05	1.50
Salt	2.50	2.50	2.50	2.50
	1000.00	1000.00	1000.00	1000.00
Determined analysis (g/kg)				
Moisture	122.50	107.00	116.20	113.50
Ash	129.50	147.90	153.10	140.40
Crude fibre (CF)	35.90	62.20	84.90	100.40
Ether extract (EF)	4.70	21.70	30.30	37.20
Crude protein (CP)	176.00	171.20	171.10	169.80
Calcium	36.50	40.90	45.80	35.20
Phosphorus	7.00	10.10	8.90	6.90
Metabolizable energy (MJ/Kg) calculated	10.84	11.20	11.40	11.56

TABLE 3

Performance of Layer Fowls fed Diets Containing Various Levels of Palm Kernel Cake

	Levels of palm kernel cake (%)			
Response criteria	*0*	*8*	*16*	*24*
Average egg lay (%)	72.60	74.37	76.21	74.17
Average total number	117.60	120.70	123.45	115.75
Mean egg weight (g)	60.96^{ab}	58.12^{b}	61.58^{a}	59.06^{ab}
FCE (kg feed egg)	2.63^{a}	2.97^{b}	2.88^{a}	3.25^{c}
Cost of feed (kg)	657.28	645.88	632.72	612.40
Feed cost (kg eggs)	1708.92	1937.64	1834.88	2020.92
Unit cost of egg	102.40	116.24	110.08	121.24

Mean with different superscripts are significantly different ($P < 0.05$).

source, thus, confirming the observations of Panigrahi & Powell (1991). The high level of residual oil renders it vulnerable to oxidation and rancidity. This view coupled with the high firbre levels have led to PKC being seldom used in layer diets. Ogbonna *et al.* (1988) reported that the digestibility of both dry matter and energy was reduced as the level of inclusion of PKC increased in broiler diets.

Egg production did not vary significantly among the groups fed the four different diets. However, birds receiving the 16 per cent PKC produced more eggs than the other treatments. McDonald *et al.* (1982) had put the maximum inclusion rate of PKC at 20 per cent in poultry diet. It appears from this study that when different levels of PKC are included in diets, attention must be devoted to balancing the energy and protein levels and other components. This could lead to efficient utilisation of the PKC. Feed conversion efficiency of the diet was highest on the control diet in comparison to all the PKC diets. However, this did not distinctly manifest in this study since the highest level of PKC inclusion of 24 per cent had led to better percentage lay than the control diet and better egg weight and egg mass than the 8 per cent PKC diet.

Conclusion

The study has indicated that PKC has value as feedstuff for the layer fowl and 16 per cent may be considered the optimum for all the economic indices in layer production.

REFERENCES

AOAC (1990) *Official methods of analysis, 15th ed.* Washington D.C.: Association of Official Analytical Chemists.

McDonald, P., Edwards, R. A. & Greenhalgh, J. F. D. (1982) *Animal nutrition,* 3rd ed. Harlow, UK: Longman.

National Research Council (NRC) (1994) *Nutrient requirements of domestic animals. Nutrient requirements of poultry,* 9th revised ed. Washington D.C.: National Academy Press.

Ogbonna, J. U., Longe, O. G. & Legel, S. (1988) Investigations of the digestibility of proximate composition in commercial palm kernel meal in broiler chick rations. *Archs Anim. Nutr.* **38**(3), 215-219.

Oloyo, E. R. A. (1991) Responses of broilers fed guinea-corn/palm kernel meal based ration to supplemental biotin. *J. Sci. Fd Agric.* **54**(4), 539-550.

Onwudike, O. C. (1986a) Palm kernel meal as a feed for poultry. 2. Diets containing palm kernel meal for starter and grower pullets. *Anim. Fd Sci. Tech.* **16,** 187-194.

Onwudike, O. C. (1986b) Palm kernel meal as a feed for poultry. 3. Replacement of groundnut cake by palm kernel meal in broiler diets. *Anim. Fd Sci. Tech.* **16,** 195-202.

Osei, S. A. & Amo, J. (1986) Palm kernel cake as a broiler feed ingredient. *Poult. Sci.* **66,** 1870-1873.

Panigrahi, S. & Powell, C. J. (1991) Effects of high rates of inclusion of palm kernel meal in broiler chick diets. *Anim. Fd Sci. Tech.* **34**(1-2), 37-47.

Snedecor, G. W. & Cochran, W. G. (1972) *Statistical methods.* Ames, Iowa, USA: Iowa State Univ. Press.

Steel, R. G. D. & Torrie, J. H. (1960) *Principles and procedures of statistics.* New York: McGraw-Hill Book Co., Inc.