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Response of Broiler Chickens to Palm Kernel Cake and Maize Offal Mixed in Different Ratios

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Abstract: A total of one hundred and twenty (120) unsexed broiler chickens of 5 days of age averaging 59.50±1.00 grams were randomly allocated into 4 dietary treatments designated I, II, III and IV to evaluate the effect of different ratios of palm kernel cake and maize offal mixed in the ratios of 1:1, 3:1 and 4:1 for treatments II, III and IV respectively and these were compared with the control diet at the starter and finishing phases. Each treatment was replicated 2 times. The results at the starter phase show that there were no significant differences ($p>0.05$) in feed intake and efficiency of feed utilization among birds fed all diets. There were also no significant differences ($p>0.05$) in feed cost per unit weight gain among birds fed the control diet and those fed the diets which contained 1:1 and 4:1 ratio of palm kernel cake and maize pap offal. However, the results at the finishing phase show that the diet which contained 3:1 ratio of palm kernel cake and maize pap offal significantly increased ($p<0.05$) feed intake while the diets which contained the ratio of palm kernel cake and maize pap offal of 1:1 and 3:1 significantly ($p<0.05$) supported better weight gain than other diets. Efficiency of feed utilization and feed cost per unit weight gain were however significantly ($p>0.05$) influenced by the dietary treatments. On the basis of the results obtained, it may be recommended that a ratio of 1:1 PKC and maize pap offal maybe fed to both starter and finishing broiler chickens without adverse effect on performance.

Key words: Broilers, maize offal, palm kernel cake, performance

INTRODUCTION

Conventional feed ingredients such as maize and soyabeans serve as staple food for Nigerians and also as good source of energy and protein for livestock and constitute about 90% of the total feed ingredients used in making poultry feeds. This has resulted in feed cost for non-ruminant animals such as pigs and poultry to account for between 70 and 80% of the total recurrent cost of production (Osuwari *et al*., 1995). Agro-industrial by-products such as palm kernel cake and maize offal could be used to spare these conventional feed ingredients in poultry diets because of their low pricing and availability.

Palm Kernel Cake (PKC), is a by-product of hydraulic press oil extraction of the endosperm of oil palm fruit (*Elaeis guinensis*, Jacq) and sells for about 8:00-12:00 naira per kg (Afolabi *et al*., 2008). The production is not seasonal as the oil palm tree produces fruits all year round. However, the peak of production falls between the months of March and May when seasonal protein meal sources are scarce and expensive (Aduku *et al*., 1988). Results of analyses of palm kernel cake (Abonyi and Uchendu, 2005) showed that this by-product contain 90.89, 22.84, 4.02, 12.85, 58.06 and 2.23% of dry matter, crude protein, crude fibre, ether extract, Nitrogen-Free Extract (NFE) and ash respectively depending on the efficiency of oil extraction from the kernel (Onwudike, 1986). Sundu *et al*. (2005) have reported that the cake is moderately rich in metabolizable energy of between 1479 and 2260 Kcal/kg. However, the crude protein content of palm kernel cake is lower than that of all protein concentrate feedstuffs. Successful utilization of PKC in diets of broilers, layers and local chicks have been documented severally in literature (Onwudike, 1986; Onifade and Babatunde, 1998; Abonyi and Uchendu, 2005; Ugwuene *et al*., 2005; Sundu *et al*., 2005; Akpodiete, 2007).

According to Aduku (1993), maize offal contain 13.38, 3.43, 2.58, 78.54 and 2.35% of crude protein, crude fibre, ether extract, Nitrogen-Free Extract (NFE) and ash respectively. Vantsawa *et al*. (2007) reported that maize offal (*dusa*) is a by-product obtained by dehulling maize grain containing the testa, aleurone layer, reasonable quantities of broken endosperm and most of the germ of the maize grain using the locally fabricated machines. These workers also reported that large quantities of maize offal are produced in Nigeria since this cereal grain feature prominently in human diets in many parts of Nigeria. This by-product has been successfully fed to finishing broiler chickens at 10% level of inclusion

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(Onuh, 2006), 40% level of inclusion in broiler chick diets in the presence of 200 mg/kg of Roxazyme enzyme (Onu *et al*., 2006), 100% of *dusa* replaced maize in the diets of egg-type chicks (Vantsawa *et al*., 2007) and equal proportions of maize and maize offal (*dusa*) could be fed to pullets (Vantsawa *et al*., 2008) without adverse effect on performance.

There is a paucity of information in literature with respect to mixture of different ratios of PKC and maize offal in the diets of broiler chickens. This is the thrust of the present study whereby palm kernel cake and maize offal were mixed in the ratios of 1:1, 3:1 and 4:1 respectively and then included in broiler starter and finishing broiler diets and these diets were compared with the control diet.

MATERIALS AND METHODS

The palm kernel cake used in the present study was obtained from a commercial agro-service shop that sells livestock feeds, feed ingredients and veterinary drugs and equipment in Gboko town, Benue State while the maize offal was obtained from local processors who mill maize grain for human consumption in Gboko, Benue State.

Experiment 1: A total of one hundred and twenty (120) unsexed broiler chickens of 5 days of age averaging 59.50±1.00 grams were purchased from a commercial vendor and randomly allocated into 4 dietary treatments of 30 birds in each treatment. Each treatment was replicated 2 times with each replicate having 15 birds. Four (4) diets designated I, II, III and IV were formulated for broiler starter chickens such that the palm kernel cake and maize offal were mixed in the ratios of 1:1, 3:1 and 4:1 and then included in rations for treatments II, III and IV respectively and these were compared with the control diet (Table 1). The birds were reared according to standard procedures (Dafwang and Ogundipe, 1982). The chicks were maintained on these diets and water being provided *ad libitum* until they were four weeks old. Records of feed consumed and live weight changes were kept for 28 days.

Experiment 2: At the end of experiment 1, the birds averaging 539.66±13.80 grams were polled together and randomly allocated into 4 dietary treatments designated I, II, III and IV such that palm kernel cake and maize offal were mixed in the ratios of 1:1, 3:1 and 4:1 and then included in rations for treatments II, III and IV respectively and these were compared with the control diet (Table 2). The birds were given feed and water *ad libitum* until they were eight weeks old, observing standard broiler production practice and keeping records of feed consumed and live weight changes for 28 days.

Table 1: Percent composition of broiler starter test diets

	Dietary treatments			
Ingredients	I	II	III	IV
Maize	40.00	41.50	41.50	41.50
FFRSB[a]	50.00	35.00	35.00	35.00
Palm kernel cake	0.00	10.00	15.00	16.00
Maize offal	0.00	10.00	5.00	4.00
Rice offal	6.00	0.00	0.00	0.00
Bone ash	3.00	3.00	3.00	3.00
Common salt (NaCl)	0.25	0.25	0.25	0.25
Mineral-vitamin premix	0.25	0.25	0.25	0.25
DL- Methionine	0.25	0.25	0.25	0.25
L-Lysine HCl	0.25	0.25	0.25	0.25
Total	100.00	100.00	100.00	100.00
Calculated analysis				
Crude protein (%)	23.02	22.68	22.73	22.74
ME (Kcal/kg)	3070	2996	2972	2968
Crude fibre (%)	4.99	6.23	7.18	7.37
Methionine (%)	0.66	0.66	0.66	0.67
Lysine (%)	1.77	1.70	1.70	1.70
Meth. + Cystine (%)	0.92	0.93	0.93	0.93
Feed cost/kg (₦/kg)	67.94	63.30	63.50	63.54

ME = Metabolizable Energy (Kilocalories per kg of diet);
a = Full-fat roasted soyabean.
The PKC and Maize Pap offal in treatments II, III and IV were mixed in the ratios of 1:1, 3:1 and 4:1 respectively

Table 2: Percent composition of finishing broiler test diets

	Dietary treatments			
Ingredients	I	II	III	IV
Maize	44.50	41.50	41.50	41.50
FFRSB[a]	40.00	35.00	35.00	35.00
Palm kernel cake	0.00	10.00	15.00	16.00
Maize offal	0.00	10.00	5.00	4.00
Rice offal	12.00	0.00	0.00	0.00
Bone ash	2.50	2.50	2.50	2.50
Common salt (NaCl)	0.25	0.25	0.25	0.25
Mineral-vitamin premix	0.25	0.25	0.25	0.25
DL-Methionine	0.25	0.25	0.25	0.25
L-Lysine HCl	0.25	0.25	0.25	0.25
Total	100.00	100.00	100.00	100.00
Calculated analysis				
Crude protein (%)	20.04	19.21	19.42	19.46
ME (Kcal/kg)	2953	3045	3011	3004
Crude fibre (%)	5.97	5.78	6.76	6.96
Methionine (%)	0.61	0.60	0.61	0.61
Lysine (%)	1.52	1.41	1.42	1.42
Meth. + Cystine (%)	0.85	0.84	0.85	0.85
Feed cost/kg (₦/kg)	63.70	60.32	61.52	61.77

ME = Metabolizable Energy (Kilocalories per kg of diet);
a = Full-fat roasted soyabean.
The PKC and Maize Pap offal in treatments II, III and IV were mixed in the ratios of 1:1, 3:1 and 4:1 respectively

Data analysis: In each experiment, data on each parameter was subjected to the Analysis of Variance (ANOVA) for Completely Randomized Design (CRD) and where significant differences were indicated, the means were separated using Hsu's MCB (Multiple Comparison with the Best) method (Minitab, 1991).

Table 3: Response of broiler starter chickens fed diets in which Palm Kernel Cake (PKC) and maize pap offal are mixed in different ratios

	Dietary treatments				
Parameters	I	II	III	IV	SEM
Average final weight (g)	671.05	566.67	490.00	541.67	-
Initial average weight (g)	60.50	58.50	60.00	60.50	2.84^{NS}
Average daily weight gain	21.81^{a}	18.15^{ab}	15.36^{b}	17.18^{ab}	5.34
Average daily feed intake	52.84	51.73	49.68	50.92	11.77^{NS}
Feed conversion ratio	2.42	2.85	3.23	2.96	1.06^{NS}
Feed cost per unit weight gain (₦/gain)	164.41^{a}	180.41^{a}	205.11^{b}	188.08^{a}	7.74

^{a,b}Means followed by the same superscript in horizontal rows are not significantly different from one another (p>0.05).
SEM = Standard Error of Mean; NS = Not significantly different from one another (p>0.05)

Table 4: Response of finishing broiler chickens fed diets in which Palm Kernel Cake (PKC) and maize pap offal are mixed in different ratios

	Dietary treatments				
Parameters	I	II	III	IV	SEM
Average final weight (g)	1119.57	1490.48	1428.26	1293.75	-
Initial average weight (g)	541.07	553.45	525.86	543.10	-
Average daily weight gain	20.67^{b}	33.47^{a}	32.23^{a}	26.81^{b}	7.07
Average daily feed intake	86.94^{d}	101.46^{b}	106.85^{a}	92.43^{c}	3.41
Feed conversion ratio	4.21	3.03	3.32	3.45	1.99^{NS}
Feed cost per unit weight gain (₦/gain)	268.18	182.77	204.25	213.12	123.11^{NS}

^{a,b}Means followed by the same superscript in horizontal rows are not significantly different from one another (p>0.05).
SEM = Standard Error of Mean; NS = Not significantly different from one another (p>0.05)

RESULTS AND DISCUSSION

The summary of results of the response of broiler starter chickens fed diets in which Palm Kernel Cake (PKC) and maize pap offal are mixed in the ratios of 1:1, 3:1 and 4:1 for dietary treatments II, III and IV respectively and compared with the control diet are presented in Table 3 while the response at the finishing phase are presented in Table 4.

The results at the starter phase show that there were no significant differences (p>0.05) in feed intake and efficiency of feed utilization among birds fed all diets. The results also show that there were no significant differences (p>0.05) in feed cost per unit weight gain among birds fed the control diet and those fed the diets which contained 1:1 and 4:1 ratio of palm kernel cake and maize pap offal.

The results at the finishing phase also show that the diets which contained the ratio of palm kernel cake and maize pap offal of 1:1 and 3:1 significantly (p<0.05) supported better weight gain than other diets. Finally, efficiency of feed utilization and feed cost per unit weight gain were not significantly (p>0.05) influenced by the dietary treatments.

In the present study, increasing levels of palm kernel cake reduced feed intake and reduced efficiency of feed utilization. The results of the present study are conflicting with those of previous studies. Onwudike (1986) reported that increasing levels of palm kernel cake increases the fibre content, reduces palatability and low availability of amino acids and energy in the diet. However, Odunsi *et al*. (2002) compared Palm Kernel Cake (PKC), Brewers Dried Grains (BDG), Maize Bran (MB) and Wheat Bran (WB) at 30% with maize/groundnut cake based diet and reported that feed intake of the agro-industrial by-products was significantly enhanced while weight gain was not affected.

The better performance of broiler starter chickens fed the control diet and the diets which contained 1:1 and 4:1 palm kernel cake and maize pap offal respectively agrees with the findings of Ezieshi and Olomu (2004) who reported that broiler chickens fed maize offal based diet performed better than those fed palm kernel cake based diet. It is known that the chicken is known to be especially sensitive to dietary energy concentration (Scott *et al*., 1982) and fibre content of the feed (Yaakugh *et al*., 1988). These workers had reported that high fibre diets reduces digestibility of the diet. This may be the case with results of the present study where different ratios of palm kernel cake and maize pap offal increase the crude fibre content of the diets. The better performance of finishing broiler chickens fed diet II (ratio of 1:1 PKC and maize pap offal) could have been due to its superior metabolizable energy content since dietary energy concentration is a function of weight gain for finishing broiler chickens.

On the basis of the results obtained, it may be recommended that diet II (ratio of 1:1 PKC and maize pap offal) maybe fed to broiler starter or finishing broiler chickens without any adverse effect on performance characteristics.

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