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Performance of Broilers Fed Varying Levels of Palm Kernel Cake

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Abstract: The high cost of conventional feed ingredients has necessitated the investigation into unconventional readily available feedstuffs such as Palm Kernel Meal (PKM). The study was conducted to determine the effect of using different levels of PKM in broilers chicks diet on performance, cost effectiveness, blood chemistry and carcass characteristics. Two hundred (200) day old Anak 2000 broiler chicks were in a completely randomized design allocated to five dietary treatments (0, 10, 20, 30 and 40% PKM) in four replicates. The birds were fed isonitrogenous and isocaloric diets containing 21% crude protein and 2700 kcal/kgME at the starter phase and 23% CP and 3000 kcal/kgME for the Finisher phase. The result showed that the feed intake and daily weight gain increases significantly ($p<0.05$) with increase in PKM inclusion up to 30% while the FCR were similar to the control. Performance in terms of daily weight gain and FCR indicated that birds on PKM diet perform equally well as those on the control diets. Similarly, the feed cost/kg weight gains were slightly better on the PKM based diet than the control. The result of the blood biochemical analysis showed there was no significant treatment effect on all the haematological parameters measured, which indicates that PKM does not contain any anti nutritional factor. Similarly, the carcass analysis showed non-significance effect of level of PKM on most of the organs except the heart, gall bladder and back weight. The gall bladder and back weight showed significant ($p<0.05$) increase with increase in PKM inclusion level while the heart weight was not following any particular pattern. These findings show that PKM can be included at 30% level in the diet of broilers without a negative effect on performance, carcass yield and blood constituents.

Key words: Palm kernel cake, performance, blood biochemistry, carcass characteristics, broilers

INTRODUCTION

Malnutrition especially inadequate animal protein intake is one of the major problems hindering development in most developing countries. According to Oyawoye (1999), the population growth rate in developing is greater than the growth rate of animal and animal products. Similarly, Albert (1990) observed that while production of agricultural commodities grew by an average of 1.5% per annum between 1970 and 1980 the population growth rate was between 2.8 and 3.0%. He recommended a minimum 40 g animal protein intake for a mature adult daily. The per capita animal protein intake of 3.5 g per day in Nigeria is however very far from this recommendation. The low intake is due to low supply and high prices of animal products (Oyawoye, 1999). There are therefore the need to bridge this gap.

In an effort to bridge, this gap Nigeria has followed the rest of the world in adopting the intensive system of poultry production. Yusuf *et al.* (1993) reported that poultry keeping in Nigeria has developed from a backyard business to a commercial oriented industry. According to Ikani (2001), poultry comes fourth among the major sources of animal protein for human consumption in Nigeria and constitute about 10% of the total meat production. FAO (1993) also showed that poultry meat represent 23.6% of the world meat production in 1992. Law and Payne (1999) attributed the continued growth of the poultry industry in many countries to the efficiency of poultry in converting vegetable protein into animal protein, the attractiveness and acceptability of poultry products to all religions and relative case with which new technologies can transfer between countries.

Poultry refers to all domestic birds raised for meat or egg (Ikani, 2001). They have a short digestive tract similar to that of human beings. The nature of their digestive tract makes them to be in direct competition with man for the scarce grain resources. This has lead to increasing cost and reduced availability of feed). Feed account for as high as 71-86% of the total cost of production of poultry products (Sanni and Ogundipe, 2005; Church, 1991). This has stimulated poultry nutritionist all over the world to search for and investigated cheaper locally available feedstuffs. Oyawoye (1999) emphasized the importance of sourcing for alternative plant proteins for human and animal nutrition in Nigeria, mainly because of the scarcity of the conventional, plant protein sources such as soya bean meal, groundnut cake and cotton seed cake. Furthermore, the use of cereal grains for poultry is questionable, as cereal remains the stable diet of most Nigerians. There are a host of agro industrial by products that can be used in the diet of poultry that can led to reduce cost of feeding and increase profit margin of producers (Oyawoye and Nelson, 1999).

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Table 1: Percentage composition of broiler starter diets

	Level of Palm Kernel Meal (PKM) in the diet				
Ingredient	0%	10%	20%	30%	40%
Maize	55.51	47.49	38.50	30.50	22.49
Soya bean meal	35.49	33.51	31.50	28.50	26.51
Palm kernel meal	0.00	10.00	20.00	30.00	40.00
Fish meal	5.00	5.00	5.00	5.00	5.00
BM	3.25	3.25	3.25	3.25	3.25
Salt	0.30	0.30	0.30	0.30	0.30
Vit. Premix*	0.25	0.25	0.25	0.25	0.25
Lysine	0.10	0.10	0.10	0.10	0.10
Methionine	0.10	0.10	0.10	0.10	0.10
Palm oil	0.00	0.00	1.00	2.00	2.00
Total	100.00	100.00	100.00	100.00	100.00
Calculated analysis					
Crude protein (%)	23.00	23.00	22.95	23.00	23.04
ME (kcal/kg)	2844.00	2794.86	2792.86	2802.94	2753.40

*Vit/mineral premix: Vitamin A12, 500,000 i.u, vit D3 2,500,000 i.u, vit E 30,000 i.u vit K2, 500 mg, Riboflavin 6,000 mg, Pantothenic acid 10,000 mg, vit. B1 2,000 mg, Niacin 30,000 mg, vit B12 2,000 mg, Biotin 50 mg, folic acid 1,000 mg, Choline chloride 300 mg, antioxidant 125, Iron 100 gr, manganese 100 gr, Zinc 100 gr, Iodine 1.5 gr, Cobalt 0.5 gr, selenium 0.1 gr and copper 10.0 gr

Table 2: Percentage composition of broiler finisher diets

	Level of Palm Kernel Meal (PKM) in the diet				
Ingredient	0%	10%	20%	30%	40%
Maize	60.29	53.22	44.16	35.10	27.02
SBM	30.76	27.83	25.89	23.95	22.03
PKM	0.00	10.00	20.00	30.00	40.00
FM	5.00	5.00	5.00	5.00	5.00
BM	3.20	3.20	3.20	3.20	3.20
Salt	0.30	0.30	0.30	0.30	0.30
Vit. Premix	0.25	0.25	0.25	0.25	0.25
Lysine	0.10	0.10	0.10	0.10	0.10
Methionine	0.10	0.10	0.10	0.10	0.10
Palm oil	0.00	0.00	1.00	2.00	2.00
Total	100.00	100.00	100.00	100.00	100.00
Calculated analysis					
Crude protein (%)	20.97	21.05	21.00	21.00	20.99
ME (kcal/kg)	3128.33	3059.00	3035.88	3012.00	2942.10

A typical example is Palm Kernel Meal (PKM). It is a by-product of the African palm oil industry, which can be fed to poultry because of its availability and low cost (Perez *et al*., 2000). World report (2003) indicated Nigeria as the third largest world producer and exporter of PKM after Malaysia and Indonesia. Several studies conducted on PKM (Onwudike, 1986; Zumbodo *et al*., 1987; Perez *et al*., 2000) have shown that it is a reasonable and promising alternative for poultry. Thus, this study sought to examine effect of different levels of PKM in the diet of broiler chicks on their performance, cost effectiveness, blood chemistry and carcass characteristics.

MATERIALS AND METHODS

Animal feeding and management: Two hundred (200) one week old Anak broilers were randomly allocated to five (5) dietary treatments with four (4) replicates having ten (10) chicks each. Birds were fed iso-nitrogenous diet (23% CP) during starter phase and 21% CP during the finisher phase. The diets were also isocaloric and this was achieved using palm oil. The five diets were formulated in which PKM was included at 0, 10, 20, 30 and 40% levels, designated as diets 1, 2, 3, 4 and 5 respectively. The composition of diets used in the starter and finisher phases are presented in Table 1 and 2 respectively. The experimental design was a completely randomized design. At the end of the eight (8) weeks feeding trial, two birds per replicate were slaughtered for carcass analysis. The following parameters were measured dressed weight, weight of gizzard, liver, heart, shank, head, feet, lung, using an electronic balance (ACCULAB). Blood samples were collected through the jugular vein during slaughter into sample bottles for biochemical (Total protein, albumen, globulin, urea, uric acid and glucose) and haematological (packed cell volume and haemoglobin) analysis. These were determined using the commercial reagent kit by Biomedion.

Data collection: Data were collected on daily feed intake and mortality. The birds were also weighed weekly. The prevailing market prices of the ingredients at the time of study were used to calculate the cost per kg feed consumed and the cost of feed/kg weight gain. The data collected were subjected to analysis of variance and mean separation using SPSS (1996).

RESULTS AND DISCUSSION

The results of the performance of the broilers fed varying levels of PKM as present in Tables 3, 4 and 5. The daily feed intake during the starter phase (as shown in Table 3) ranged from 51.72-59.09 g and showed a significant ($p<0.05$) treatment effect. Feed consumption increased with increasing PKM levels in the diets, with broilers fed the control (0%PKM) diet having significantly ($p<0.05$) least feed intake which was similar to intake of birds on 10% PKM diet (diet 2). The feed intake during the finisher phase (Table 4) though not significant ($p>0.05$) follow the same trend as in the starter phases. The intake was also increasing with PKM inclusion level. Sundu *et al.* (2005) also reported a similar increase in feed intake with increase in PKM inclusion level in the diets of broilers. The result obtained in this study thus collaborated that of Sundu *et al.* (2005). This increase in daily feed intake with inclusion level could be due to energy dilution of the diet by PKM and an attempt by the broilers to consume enough feed to meet their energy requirement (Onifade and Babatunde, 1998). This could also be due to palm oil added to boost the energy at higher PKM inclusions.

The daily weight gain as show in Tables 4, 5 and 6 showed that broilers feed PKM diet had daily gain that were better or comparable to those on the control. The values obtained were similar to what was reported by Okeudo *et al.* (2005) on different levels of PKC.

The FCR was not significantly different between treatment means during the starter phase (Table 3) but was significant ($p<0.05$) during the finisher phase, similarly the overall mean of both phases (Table 5). The birds on control diet were more efficient in converting feed to gain and this was similar to 10-30%PKM diets. This observation shows that PKM can be included up to 30% in broilers diet with performance similar to the control. This agrees with Onifade and Babatunde (1998) that at higher inclusion level of by products in broilers diet, there is rapid passage of the digestion along the digestive tract and reduced retention of dry matter.

The feed cost per kg showed a gradual decrease with increasing level of inclusion of PKM in the diet. It ranged from Naira 49.52-66.59k with 40% and 0% PKM respectively during the starter phase. Similarly, it ranged from Naira 49.33 -66.40k for the finisher diet for 40% and 0% PKM diets respectively. The feed cost per kg weight gain declined up to 30% level of PKM inclusion, but increased with 40% inclusion. This was due to lower feed efficiency and the reduced gain of broilers obtained on that diet. The lower feed cost of PKM diet compared to control was in order because PKM was cheaper than soya bean meal and readily available locally.

Table 3: The effect of varying levels of PKM on performance of broiler during the starters phase

	Level of Palm Kernel Meal (PKM) in diet					
Parameters	1 (0%)	2 (10%)	3 (20%)	4 (30%)	5 (40%)	SE
Daily feed intake (g)	51.72^{c}	52.68^{bc}	56.60^{ab}	59.09^{a}	56.80^{ab}	1.37*
Daily wt gain (g)	19.66	20.56	21.63	21.29	17.73	1.113^{NS}
Feed con. ratio	2.93	2.86	2.77	2.83	3.60	0.26^{NS}
Mortality	5.00	7.50	2.50	0.00	10.00	
Feed cost/kg (Naria)	66.59	61.92	58.05	54.20	49.52	
Feed cost/kg gain	195.11	177.09	160.80	153.39	178.27	

^{abc}Means bearing different superscripts within the rows differ significantly. NS = Not Significant ($p>0.05$)

Table 4: The effect of varying levels of PKM on performance of broiler finishers

	Level of Palm Kernel Meal (PKM) in the diets					
Parameters	0%	10%	20%	30%	40%	SE
Daily feed intake (kg)	112.95	126.97	129.18	130.29	133.88	4.59^{NS}
Daily weight gain (kg)	38.50^{ab}	40.55^{a}	38.18^{ab}	38.65^{ab}	33.79^{b}	1.95*
FCR	3.32^{b}	3.53^{ab}	3.96^{ab}	3.48^{ab}	4.69^{a}	0.31*
Feed cost (kg)	66.40	61.68	57.84	54.01	49.33	
Feed cost/kg gain (Naira)	220.45	217.73	229.05	187.96	231.36	

^{abc}Means bearing different superscript within the rows differ significantly ($p<0.05$). NS = Not Significant ($p>0.05$)

Table 5: The effect of varying levels of PKM on overall performance of broiler

	Level of Palm Kernel Meal (PKM) in diet					
Parameters	0%	10%	20%	30%	40%	SE
Daily feed intake	82.05^{a}	89.82^{ab}	92.89^{a}	94.69^{a}	95.34^{a}	2.62*
DWG (g)	29.08	30.55	29.91	27.93	25.76	1.50^{NS}
FCR	2.83^{b}	2.95^{b}	3.12^{ab}	3.44^{ab}	3.72	0.16*
Mortality (%)	5.00	7.50	2.50	0.00	10.00	

*Means bearing different superscripts within the rows are significantly different ($p>0.05$). NS = Not Significant

Table 6: The effect of varying level of PKM on blood chemistry of broilers

	Level of inclusion of PKM					
Parameters	0	10%	20%	30%	40%	SE
Haemoglobin (g/dl)	11.80	12.78	12.30	11.79	12.26	1.076^{NS}
PCV (%)	33.53	38.33	36.90	35.36	36.79	3.220^{NS}
Total Protein (g/dl)	3.05	3.30	3.19	3.21	3.21	0.201^{NS}
Albumin (g/dl)	1.73	1.79	1.68	1.91	1.68	0.880^{NS}
Globulin (g/dl)	1.30	1.58	1.48	1.26	1.49	0.201^{NS}
Glucose (mmol/L)	15.68	14.86	14.45	15.00	15.01	0.488^{NS}
Urea (mmol/L)	3.34	3.73	3.78	3.51	3.21	0.370^{NS}
Uric acid (mmol/L)	244.00	295.50	315.25	248.63	269.13	35.19^{NS}

NS = Not significant

Table 7: The effect of varying levels of PKM on carcass characteristics of broilers

	Level of inclusion of PKM					
Parameters	0%	10%	20%	30%	40%	SE
Live weight (g)	1996.88	1881.25	1781.25	1893.75	1915.63	93.614^{NS}
Slaughter weight (%)	94.18	95.81	94.65	93.78	92.63	11.308^{NS}
Plucked weight (%)	88.14	90.95	88.78	89.66	88.05	1.522^{NS}
Dressed weight (g)	1562.50	144.75	1390.63	1500.00	1443.75	89.850^{NS}
Dressing (%)	78.69	76.88	68.16	77.24	73.24	40.760^{NS}
Gizzards (%)	2.61	2.87	3.04	2.88	3.00	0.217^{NS}
Heart (%)	0.55^{abc}	0.61^{ab}	0.62^{a}	0.53^{bc}	0.50^{c}	0.025*
Liver (%)	1.97	2.23	1.88	2.30	2.07	0.152^{NS}
Bile (%)	0.19^{b}	0.19^{b}	0.14^{c}	0.20^{b}	0.27^{a}	0.012*
Intestine (%)	5.09	5.40	4.70	5.17	5.29	0.330^{NS}
Neck (%)	4.41	4.95	4.55	4.65	4.31	0.275^{NS}
Shank (%)	4.09	4.44	4.48	4.29	4.03	0.296^{NS}
Thighs (%)	19.70	21.47	20.56	19.71	18.25	1.347^{NS}
Lungs (%)	8.48	8.37	9.05	7.63	7.79	0.492^{NS}
Back (%)	15.91^{a}	15.78^{a}	13.38^{ab}	11.67^{bc}	13.73^{ab}	0.841*
Breast (%)	15.94	16.87	16.05	16.58	16.90	0.852^{NS}
Head (%)	2.77	2.88	2.80	2.82	2.80	0.135^{NS}

^{abc}Means bearing different superscripts within the same row differ significantly (p>0.05). NS = Not Significant

The blood constituents are the biochemical medium of transportation in all animals and thus their status show the healthiness of the birds. The blood analysis (Table 6) showed non-significant effect of PKM inclusion for all the parameters considered. Akinfala *et al.* (2007) obtained similar results with cockerels fed processed cassava meal. This observation shows that PKM was not toxic or detrimental to broilers.

Dietary effect on organs, tissues weight and body development may affect carcass characteristics of birds. The dressing percentage observed varied from 68.16-78.60% and apparently did not follow any particular pattern. All the parameters determined showed a non-significant treatment effect except for the heart, gall bladder and back weight (Table 7). Iyayi *et al.* (2005) reported a similar significant effect of three (3) fibre sources on back and heart weight of broilers. The broilers fed 40%PKM had significantly higher gall bladder weight compared to the others. Several researchers have also reported on the non-significant effect of PKM inclusion on carcass characteristics of birds (Okeudo *et al.*, 2005; Olorede and Alayande, 1999; Orunmuyi *et al.*, 2006).

Conclusion: The result of the study have shown that palm kernel meal can be incorporated into broilers diet up to 30% level without adverse effect on performance, carcass yield and blood chemistry. This would go a long way in easing the pressure on conventional feedstuffs and hence contribute to increase in animal protein production, availability and affordability to our teeming population.

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