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Performance, Carcass Characteristics and Blood Composition of Broilers Fed Varying Levels of Palm Kernel Meal (*Elaise guinensis*) Supplemented with Different Levels of Fishmeal

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Abstract: An experiment was conducted to evaluate the performance, carcass characteristic and blood composition of broilers fed palm kernel meal based diet supplemented with two levels of fish meal. Two hundred and ten (210) day old Anak broiler chicks were randomly allocated to seven dietary treatments in which PKM was used at graded levels to replace maize and Groundnut Cake (GNC) in the diets. The diets were supplemented with either low (2%) or high (5%) levels of fish meal. The results of the performance parameters showed a significant treatment effect. The daily feed intake showed a significant increase with PKM inclusion level up to 30% but declined thereafter. The daily weight gains recorded were better at all levels compared to the control. The feed conversion ratio similarly increased with increase in PKM inclusion levels, just as feed intake and weight gain also increased with FM inclusion level. However, the FCR decreased with increasing levels of fishmeal. The feed cost/kg tended to decrease with increasing PKM levels but increased with an increase FM levels. However the feed cost/kg weight gain increased as the level of PKM was increased. The blood constituents of the broilers were not affected by dietary levels of PKM and FM except for the urea ($p<0.05$). Though, there was no definite pattern. The carcass analysis was also not affected by PKM and FM inclusion levels except for the plucked weight which was lower at 5% FM level. The result indicated that PKM can be included at 45% in a corn- groundnut cake diet supplemented with 5% fish meal without detrimental effects on performance, carcass yield and blood composition of broilers. However, 30% seems to be most economical.

Key words: Broilers, fishmeal, palm kernel meal, performance

INTRODUCTION

The cost of feeding is said to be the single most recurring expenditure in poultry production. Church (1991) observed that 75% of the cost of raising or maintaining poultry is attributable to feed cost. In an effort to reduce feed cost, a lot of work has been carried out on non-conventional feed sources like palm kernel meal. Palm kernel meal along with palm oil and palm kernel oil are obtained from the oil palm tree (*Elaise guinensis*). Gascon *et al*. (1989) describe the oil palm tree as originating from Nigeria with its natural habitat in the humid tropics.

Chin (2007) argued that though PKM supply both protein and energy, it is used more as a protein source. The author described it as a medium grade protein, ranked a little higher than copra cake but lower than fishmeal and groundnut cake. Daghir (1995) classified PKM as a novel feed stuff, with a fairly good quality protein and balance of calcium and phosphorus. McDonald *et al*. (1995) and Alimon (2004) however describe the amino acid balance as poor and observed the limiting amino acid as lysine and methionine. Lysine and methionine are necessary as building blocks for all proteins in animals' body. According to Olomu (1995) deficiency of these amino acids can lead to reduced appetite, retarded growth and poor feed efficiency. Sundu *et al*. (2005) also reported that though the amino acid content of PKM is low, its availability is very high, exceeding 85% and can serve as adequate replacement for some of the conventional feedstuffs in poultry diet if adequately supplemented with animal protein or deficient amino acids.

Ojewola *et al*. (2003) observed improve weight gain, feed efficiency and decreased feed cost per kg weight gain when dietary PKM supplemented with 0.2% of both lysine and methionine were fed to turkey poults in tropical environment. Fish meal is a high quality animal protein feed ingredient. It is rich in all essential amino acids, vit B, choline, riboflavin, calcium and phosphorus.

It is usually included in animal feeds to supply essential amino acids that are deficient in plant protein sources. It is very important in the diet of simple stomach animals, particularly young animals whose demand for protein and essential amino acids are very high with inclusion rates of 1.5-5%. Its inclusion in feed is however seriously constrained by its cost. This experiment thus evaluated the performance and cost effectiveness of broilers fed graded levels of PKM supplement with low and high levels of fish meal.

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Table 1: Percentage composition of broiler starter diets containing varying levels of PKM with two levels of fish meal

	Levels of PKM with two levels of fish meal						
Ingredient	0%	15%F1	30%F1	45%F1	15%F2	30%F2	45%F2
Maize	56.21	45.04	29.54	20.03	46.50	31.21	17.59
GNC	39.84	34.01	31.55	24.02	29.55	26.84	23.46
PKM	0.00	15.00	30.00	45.00	15.00	30.00	45.00
Fish meal	0.00	2.00	2.00	2.00	5.00	5.00	5.00
Bone meal	3.20	3.20	3.20	3.20	3.20	3.20	3.20
Salt	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Vit premix	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Lysine	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Methionine	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Palm oil	0.00	0.00	3.00	5.00	0.00	3.00	5.00
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Calculated analysis							
CP %	23.01	23.00	23.00	23.00	23.00	23.00	23.00
ME (kcal/kg)	2836.00	2782.00	2825.00	2830.00	2810.00	2831.00	2819.00
Crude fibre (%)	3.84	4.76	5.72	6.57	4.57	5.52	6.50
Ether extract (%)	4.64	4.43	7.07	8.86	4.45	7.09	8.76
Calcium (%)	1.24	1.35	1.56	1.68	1.41	1.62	1.76
Phosphorus (%)	0.98	1.03	1.07	1.07	1.08	1.10	1.12
Lysine (%)	0.93	0.99	0.99	0.94	1.04	1.05	1.05
Methionine	0.39	0.45	0.48	0.49	0.50	0.53	0.56

Notation: F1- Fish meal at 2%; F2- Fish meal at 5%; ME - Metabolizable Energy

Table 2: Percentage composition of broiler finisher diet containing varying levels of PKM with two levels of FM

	Levels of PKM with two levels of FM						
Ingredients	0%	15%F1	30%F1	45%F1	15%F2	30%F2	45%F2
Maize	61.96	50.50	35.09	20.60	52.13	36.76	22.06
Groundnut cake	34.28	28.46	25.96	23.45	23.95	21.29	19.00
Palm kernel meal	0.00	15.00	3.00	45.00	15.00	30.00	45.00
Fish meal	0.00	2.00	2.00	2.00	5.00	5.00	5.00
Bone meal	3.20	3.20	3.20	3.20	3.20	3.20	3.20
Salt	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Vit premix	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Lysine	0.20	0.20	0.20	0.20	0.20	0.20	0.20
Palm oil	0.00	0.00	3.00	5.00	0.00	3.00	5.00
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Calculated analysis							
CP (%)	21.00	21.01	20.98	20.99	21.00	21.08	21.01
ME (kcal/kg)	2806.00	2743.00	2808.00	2822.00	2784.00	2846.00	2858.00
Crude fiber (%)	3.66	4.40	5.39	6.41	4.24	5.21	6.24
Ether extract (%)	4.54	4.32	6.96	8.65	4.35	6.98	8.67
Calcium (%)	1.23	1.31	1.51	1.65	1.39	1.59	1.73
Phosphorus (%)	0.97	1.03	1.05	1.07	1.06	1.09	1.11
Lysine (%)	0.85	0.90	0.91	0.93	0.96	0.97	0.98
Methionine (%)	0.38	0.45	0.46	0.49	0.50	0.52	0.55

MATERIALS AND METHODS

Two hundred and ten (210) one week old Anak broilers were randomly allocated to seven (7) dietary treatments. The treatments were in three (3) replicates with ten (10) birds per replicate. The diets consisted of three levels of PKM supplemented with two levels (2 and 5%) of fishmeal. The control (A) had no PKM and fish meal. Diet B to D had 15, 30 and 45% level of PKM with low level (2%) of FM, while diets E-G also had 15, 30 and 45% PKM' with high level (5%) of FM. The diets were iso-nitrogenous (23% and 21%CP for starter and finisher phases respectively) and were also balanced in metabolizable energy within the recommended range (Olomu, 1995) by adding palm oil. The composition and proximate analysis of diets are presented in Table 1 and 2. The experimental design was a 3 x 2 factorial experiment with three levels of PKM and two levels of fish meal. There were a total of seven treatments including the control. 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 into sample bottles for biochemical (Total protein, albumen, globulin, urea, uric acid and glucose) and haematological (packed cell volume and hemoglobin) analysis. These were determined using the commercial reagent kit by Biomedion.

Data were collected on daily feed intake and mortality. The birds were also weighed weekly. The prevailing market price of the feed ingredients was used to calculate the cost of feed per kg and feed cost per kg weight gain. The data collected were subjected to analysis of variance and mean separation using SPSS (1996).

RESULTS AND DISCUSSION

The performance of broilers fed varying levels of PKM with different levels of Fish meal are as shown in Table 3-5. The daily feed intake of broilers fed varying levels of PKM with difference levels of FM supplementation, showed a significant treatment effect. The value ranged from 37.82-58.91 g on control diet and 45% PKM with low (2%) level of FM respectively. The broilers fed 5% FM had a significantly higher feed intake compared to control and 2% FM diets. This indicated increase in FI at higher FM inclusions (5%) compared to 2% FM and control. Similarly the FI increased with increase in PKM inclusion up to 30% but showed decline thereafter. This observation was similar to the findings of Wingkeong and Kaikaichong (2002) on rabbits and fishes fed up to 40% PKM. The increase in feed intake could be due to dilution of the energy of the diets and an attempt by broilers to consume enough nutrients to achieve comparable growth.

The daily weight gain showed a significant treatment effect during the starter and finisher phases. The daily weight gain was higher for broilers on 5% FM compared to control and 2% FM diet. Similarly it was higher on PKM diets compared to the control. The daily feed intake and weight gain were comparable to 117.37-131.43 g and 40.81-44.00 g/day reported by Okeudo *et al.* (2005) during the finisher phase. The observed daily weight gain was a manifestation of protein intake which tends to improve growth and repair of tissue in the body. The FCR also showed a significant treatment effect. It increased with an increase in the level of PKM which was similar to the findings of Iyayi *et al.* (2005). The feed efficiency was better at 5% FM than at 2% FM inclusion and comparable to the control. This observation could be due to better availability of essential amino acids, which resulted in better utilization of the feed (McDonald *et al.*, 1995). This observation also agreed with the recommendation of Sundu *et al.* (2005) that high PKC diets should be supplemented with animal protein or synthetic AA for optimum performance.

Table 3: Performance of the broilers fed varying levels of PKM and two levels of fish meal in starter phase

	Level of PKM with two levels of fishmeal							
Parameters	0	15F1	30F1	45F1	15F2	30F2	45F2	SE
DFI (g)	37.82^{c}	46.44	48.28^{b}	43.03^{b}	54.88^{a}	58.19^{a}	54.99^{a}	1.214*
DWG (g)	22.05^{d}	25.61^{cd}	23.33^{d}	18.04^{c}	32.86^{a}	30.74^{ab}	28.10^{bc}	0.938*
FCR	1.90^{bc}	1.99^{b}	2.17^{b}	2.55^{a}	1.71^{c}	1.96^{b}	2.03^{b}	0.056*
Feed cost/kg (Naira)	47.30	46.10	42.25	38.51	57.77	49.94	45.51	
Cost/kg WG (#)	89.87	91.74	91.68	98.20	98.79	97.88	92.39	

*Means with different superscripts within the same row differ significantly ($p<0.05$)

Table 4: Performance of broilers fed varying levels of PKM and two levels of fishmeal in finisher phase

	Level of PKM with two levels of fish meal							
Parameters	0	15F1	30F1	45F1	15F2	30F2	45F2	SE
DFI (g)	76.99^{d}	102.94^{c}	107.30^{bc}	106.24^{bc}	110.81^{abc}	27.12^{a}	125.80^{ab}	4.536*
DWG (g)	31.26^{d}	40.96^{abc}	38.49^{bcd}	33.81^{cd}	47.75^{ab}	47.94^{a}	8.97^{bcd}	2.142*
FCR	2.80^{b}	2.64^{bc}	3.27^{abc}	3.99^{a}	2.55^{c}	2.84^{bc}	3.71^{ab}	0.236*
Feed cost/kg (Naira)	48.50	47.21	38.63	38.63	54.63	51.04	46.30	
Feed cost/kg Wt (Naira)	135.80	124.63	154.13	154.13	140.00	144.95	171.77	

^{abc}Means bearing different superscripts within the same row differ significantly ($p<0.05$).

Notation: F1 - Fishmeal at 2%; F2 - Fishmeal at 5%; DFI - Daily Feed Intake; DWG - Daily Weight Gain; FCR - Feed Conversion Ratio

Table 5: The overall Mean Performance of Broiler fed Varying Level of PKM with two level of fishmeal

	Level of PKM with two levels of fishmeal							
Parameters	0	15F1	30F1	45F1	15F2	30F2	45F2	SE
DFI	54.61^{b}	70.66^{b}	73.57^{b}	70.12^{b}	78.85^{ab}	85.34^{a}	88.14^{a}	2.92*
DWG	26.00^{dc}	32.18^{b}	29.83^{a}	24.80^{d}	39.24^{a}	38.11^{a}	32.76^{b}	1.26*
FCR	2.11^{de}	2.19^{de}	2.47^{b}	2.83^{a}	2.01^{e}	2.31^{dc}	2.61^{b}	0.144*

^{abcde}Means with different superscripts within a row are significantly

Table 6: The effect of varying levels PKM and two level of fish meal on blood constituents of broilers

Parameters	0	15F1	30F1	45F1	15F2	30F2	45F2	SE
PCV (%)	42.30	42.20	42.30	42.20	43.80	40.70	43.80	1.752^{NS}
Haemglobin (g/dl)	14.10	14.07	14.10	14.07	14.60	13.57	14.60	0.584^{NS}
Total protein (g/dl)	2.50	3.37	2.47	3.37	2.83	3.53	3.00	0.366^{NS}
Albumin (g/dl)	1.63	1.77	1.70	1.87	1.33	1.77	1.93	0.191^{NS}
Globulin (g/dl)	0.87	1.60	0.77	1.50	1.50	1.77	1.07	0.346^{NS}
Urea (mmol/L)	5.73^{ab}	4.63^{abc}	2.87^{c}	6.37^{a}	4.10^{abc}	3.63^{bc}	5.23^{abc}	0.576*
UA (mmol/L)	548.33	494.33	442.00	368.33	442.00	410.67	431.33	79.418^{NS}

^{abc}Means bearing different superscripts within the same row differ significantly. NS = Not Significant.
Notation: PCV - Packed Cell Volume. UA - Uric Acid

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

	Level of PKM with two level of fish meal							
Parameters	0	15F1	30F1	45F1	15F2	30F2	45F2	SE
Live weight (g)	1575.00	1600.00	1691.67	1325.00	1758.33	2025.00	1725.00	136.61^{NS}
Slaughter wt. (%)	93.55	97.71	98.03	98.08	97.17	96.10	95.00	1.602^{NS}
Plucked wt. (%)	90.10^{abc}	93.75^{ab}	91.06^{abc}	95.30^{a}	88.64^{bc}	86.89^{c}	90.09^{abc}	1.143*
Dressed wt. (%)	80.35	81.67	82.93	85.17	85.03	77.96	79.26	2.419^{NS}
Gizzard (%)	4.19	4.99	5.06	5.57	4.36	4.77	4.55	0.521^{NS}
Heart (%)	0.39	0.70	0.46	0.51	0.47	0.38	0.40	0.061^{NS}
Liver (%)	1.50	1.61	1.54	1.61	1.55	1.57	1.91	0.207^{NS}
Bile (%)	0.25	0.39	0.32	0.21	0.16	0.26	0.51	0.082^{NS}
Intestine (%)	3.63	5.01	4.53	4.54	3.28	3.38	3.59	0.056^{NS}
Neck (%)	4.63	4.09	3.68	4.38	3.72	3.78	3.41	0.266^{NS}
Head (%)	2.86	3.38	3.27	3.65	2.69	2.77	2.79	0.231^{NS}
Shank (%)	1.74	2.25	1.97	1.92	1.77	1.80	2.11	1.66^{NS}

^{abc}Means bearing different superscripts within the same row differ significantly. NS = Not Significant

The feed cost/kg showed decline with increase in PKM inclusion. This was normal and expected and agreed with the finding of Ezieshi and Olomu (2004). In contrast, the feed cost/kg increased with increase in FM inclusion. This is because FM is one of the most expensive feed ingredients. The feed cost/kg weight gain however increased with increase in PKM inclusion and it followed the same trend with those of the feed efficiency. This was contrary to the findings of Ojewola *et al.* (2003). They observed decreased cost per kg weight gain when PKM based diet was supplemented with synthetic lysine and methionine in turkey poults diet.

The blood constituents of broilers fed varying levels of PKM and FM are as shown in Table 6. All the blood constituents considered showed a non-significant dietary effect except urea. The PCV of 40.2-43.8% fells within the normal range of 2.5-4.5% for chicken (Mitruka and Raconsley, 1977). The haemoglobin value was however higher than normal (7-13.0 g/dl) Mitruka and Raconsley (1977). It was however comparable to 10.00-13.89 reported by Fatumbi and Makinde for local chickens in their research at Ibadan, Nigeria.

The total serum protein values were similarly lower than 6-7.50 g/dl and 4.44-6.06 g/dl reported by Fatumbi and Makinde (1985) for exotic and local chicken respectively. They were however higher than 4.9-7.8 g/dl reported by Akinmutimi and Oke (2000) for broilers fed lima bean based diets. The broilers on PKM had a numerically higher value for serum protein compared to the control it was an indication of the good quality protein of PKM. The albumin value obtained in this study was comparable to the values reported by Fatumbi and Makinde (1985) while the serum globulin was lower. This difference could be due to strains of birds and type of feedstuff used. The serum urea level showed a significant treatment effect with broilers on 45% PKM and 2% FM having significantly higher value of urea. This could be an indication of poor rates of protein catabolism (Sirois, 1995). The uric acid value for the control was numerically higher than others.

Carcass characteristics of broilers fed varying levels of PKM and FM are as presented in Table 7. The dressing percentage varied from 77.96-85.17% and appeared to be increasing with increase in PKM inclusion levels especially with 2% FM, while at 5% FM inclusion it did not follow definite pattern. All the parameters analysed showed a non-significant treatment effect except for the plucked weight which did not follow any particular trend. These findings were similar to the observations of Olorede *et al.* (1997) and Orunmuyi *et al.* (2006) that reported non-significant difference between the treatment means for most of the carcass parameters of broilers fed PKM.

Conclusion: The finding of this study revealed that the daily feed intake and feed conversion ratio increased with increase in PKM inclusion level, while the daily weight gain decreases. The daily weight gain also

increased with increase in FM inclusion level but the FCR was decreased. The feed cost/kg decreased with PKM inclusion level but increased with FM inclusion level. However the feed cost/kg weight gain showed increase with PKM inclusion level. Most of the blood constituents and carcass parameters analysed were not affected by PKM and FM inclusion levels. It can be concluded that PKM can be include at 45% level in a corn-groundnut cake diet supplemented with 5% FM without a compromise in performance, carcass yield and blood composition of broilers. However 30% seems to be more economical.

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