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Growth Response, Nutrient Digestibility and Organ Characteristics of Broiler Chicken Fed Graded Levels of Kola Pod Husk Meal (KPHM) in a Derived Savannah Zone of Nigeria

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Abstract: One hundred and forty-four (144) day old Anak 2000 broiler chicks were used to investigate the growth response as well as organ characteristics of broiler chickens fed graded levels of kola pod husk meal (KPHM). The birds were randomly allotted to four dietary treatments groups containing 0%, 10%, 20% and 30% KPHM. There were two replicates per treatments with 18 birds per replicate in a completely randomized design. The birds placed on control diet utilized their feed more efficiently ($P<0.05$) than other treatments. The broilers fed 10% and 20% KPHM were able to convert the diet more efficiently ($P<0.05$) than the broilers on 30% KPHM. Treatment effects on weight gain, feed: gain ratio, dressed weight, length of small intestine, length of colon, length of caecum, weights of kidney and lung were significantly ($P<0.05$) different. Growth rate decreased significantly ($P<0.05$) with increasing level of KPHM in the diet. However, no significant ($P>0.05$) difference was observed in protein efficiency ratio, nitrogen retention, dry matter digestibility and crude fibre digestibility of the birds fed different diets. It could be concluded that KPHM inclusion in broiler diet up to 10% dietary level will adversely affect the performance of broilers.

Key words: Kola pod husk meal, broilers, growth rate, organ characteristics

Introduction

Poultry keeping in Nigeria has been one of the most popular enterprises adopted by small and medium scale farmers in both rural and urban areas (Idowu *et al*., 2005). It is one of the sources of animal protein to the ever growing Nigerian population, thus, making significant contribution to human nutrition and economic development. The poultry groups constitute more than 57% of the total livestock production in Nigeria (Alabi and Osifo, 2004) and many people have gone into poultry production either producing egg or meat or both (Ofuoku and Aijeh, 2005).

One of the objectives of poultry production is to produce products of high quality with minimum cost in the shortest possible time. The growing demand for maize in the last few years for both human and livestock consumption has pushed its market price up to a level that has directly affected the production cost of farm animals and its products particularly non-ruminant.

Animal nutritionists have utilized some non-conventional feed sources as alternative to maize and other conventional feed ingredients in feed formulation, for example biscuit waste was used in broilers diet (Longe, 1986), cocoa husk in layers diet (Sobamiwa, 1998) as well as cocoa husk in broilers diet (Sobamiwa and Longe, 1994).

Nigeria produces 70% of world kola (*Cola nitida* Vert) and consequently the bulk of kola pod husk estimated at 210,000 tones annually are being produced (Van Ejinatten, 1964). Sobamiwa (1998) and Olubamiwa *et al*., (1999), have used KPHM as a partial substitute for maize in layers diet and reported improved shell thickness even at 60% inclusion. Kola Pod Husks have been utilized in rabbit diet (Oluokun and Olalokun, 1999) and broiler finisher (Hamzat and Babatunde 2001). This study was prompted by the paucity of information on the use of kola pod husk in broiler diets. Hence the current investigation was undertaken to assess the effect of feeding kola pod husk meal (KPHM) on growth and organ characteristics of broilers.

Materials and Methods

Site: The experiment was carried out at Poultry unit (Broiler rearing house) of Teaching and Research Farm, Ladoke Akintola University, Ogbomoso, in the derived Savannah zone of Nigeria.

Test ingredient and experimental diet: Kola pod husk was obtained from kola unit of Cocoa Research Institute of Nigeria (CRIN) Ibadan. It was properly dried and milled into Kola pod husk meal (KPHM). Other feed ingredients used for the experimental diets were purchased from a reputable feed mill within the project area. Four experimental broiler starter and finisher diets (Table 1 and 2) were formulated.

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Table 1: Gross composition of Starter Diet (%)

Ingredients	Diet 1 (0%KPHM control)	Diet 2 (10%KPHM control)	Diet 3 (20%KPHM control)	Diet 4 (30%KPHM control)
Maize	50	50	41.25	32
KPHM	0	10	20	30
Soyabean	27.55	20	20	21.25
Corn bran	4	1.7	1	0
Wheat offal	4.7	2	2	10
Fish meal	8	10.55	10	10
Palm oil	1	1	1	2
Oyster shell	2.5	2.5	2.5	2.5
Bone meal	1.25	1.25	1.25	1.25
Methionine	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25
Premix	0.5	0.5	0.5	0.5
Total	100	100	100	100
Cal. Analysis				
Crude protein	23.07	21.96	21.75	22
Crude fibre	3.75	4.42	5.8	7.03
Either extract	4.59	4.38	4.09	4.75
M.Ekca/kg	2949	2902	2762	2680

*Premix: vit A-9,000 Vit, D_3- 1,250, 000IU; vit E – 7,000IU, Riboflar Vit-6,000mg; Vit. B_3 –22,000mg; Vit. B_5 – 14,000mg; Lysine-120,000mg, methionine – 65,000mg; Choline chlorine – 240,000mg; Mn – 6,000mg; Fe – 35,000mg; Cu – 5000mg; I_2 – 1,100mg; Se^- 100mg; Antioxidants – 125,00mg.

Table 2: Composition of Finisher Diets (%)

Ingredients	Diet 1 (0%KPHM control)	Diet 2 (10%KPHM control)	Diet 3 (20%KPHM control)	Diet 4 (30%KPHM control)
Maize	42	43	36.05	33.25
KPHM	0	10	20	30
Soyabean	25	26	25	25
Corn bran	15	8	7	1
Wheat offal	10.25	5.25	4.2	2
Fish meal	3	3	3	3
Palm oil	0	0	0	1
Oyster shell	2.5	2.5	2.5	2.5
Bone meal	1.25	1.25	1.25	1.25
Methionine	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25
Premix	0.5	0.5	0.5	0.5
Total	100	100	100	100
Cal. Analysis				
Crude protein	23.07	21.96	21.75	22
Crude fibre	5.17	5.63	6.86	8.49
Either extract	3.49	3.28	3.01	3.97
M.Ekca/kg	2769	2756	2640	2817*

Premix: vit A-9,000 Vit, D_3- 1,250, 000IU; vit E – 7,000IU, Riboflar Vin-6,000mg; Vit. B_3 –22,000mg; vit. B_5 – 14,000mg; Lysine-120,000mg, Methionine – 65,000mg; Choline chlorine – 240,000mg; Mn – 6,000mg; Fe – 35,000mg; Cu – 5000mg; I_2 – 1,100mg; Se^- 100mg; Antioxidants – 125,00mg.

Experimental Animal and Management: A total of one hundred and forty four (144) one-day old "Anak 2000" broiler chicks were purchased from a local hatchery farm about 7.5km from the project site. Chicks were fed the control diet for one week after which they were randomly divided into 4 groups. Each of the groups was allocated to one of the dietary treatments with two replicates of 18 birds each to make a total of 36 birds per treatment. Feeding trial lasted for 8 weeks with one week adjustment period, 3 weeks on starter diets and 4 weeks on finisher diets. Vaccination was conventionally done as applicable to the environment here while routine medication was done to keep the birds healthy. Birds were fed twice daily at about 8.00hrs and 15.00hrs.

Data Collection

Average feed intake: This was obtained by subtracting the quantity of left over feed from total feed supplied to the birds for the day.

Body weight gain (g): The birds were weighed every week and the weekly gain was obtained by deduction of body weight of the previous week from the weight of the present week.

Table 3: Proximate Composition of Kola Pod Husk Meal (KPHM) and Experimental Diets

	KPHM	Diet 1 Starter	0% KPHM Finisher	Diet 2 Starter	10% KPHM Finisher	Diet 3 Starter	30% KPHM Finisher	Diet 4 Starter	30% KPHM Finisher
Dm%	90.06	89.76	89.14	89.76	89.16	90.14	89.07	90.67	89.1
Crude protein	9.98	24.15	19.6	22.4	19.95	22.75	21.13	22.93	20.3
Crude fibre	16.74	4.56	7.84	6.89	8.26	5.96	8.49	6.94	8.76
Either extract	7.69	3.98	4.42	4.08	5.17	4.14	5.29	4.17	5.31
Ash	13.26	9.62	6.59	10.96	9.93	11.18	10.67	11.27	10.93
NFE	42.39	47.43	47.69	45.48	45.85	46.11	44.49	45.3	43.8
ME (kcal/kg)	2,497	2,900	2,776	2,774	2,785	2,814	2,790	2,794	2,736

Table 4: Performance characteristics of Broiler chicken fed KPHM based diets

Parameters	0% KPHM	10% KPHM	20% KPHM	30% KPHM
Initial weight (g)	80	80	80	80
Final weight (g)	1586.67±0.03^{a}	1396.67±0.03^{b}	1118.34±0.06^{c}	911.67±0.04^{d}
Total weigh gain g/bird)	1508.67±0.03^{a}	1316.67±0.03^{b}	1038.34±0.06^{c}	831.67±0.03^{d}
Daily wt. Gain g/bird)	30.14^{a}	26.34^{b}	20.76^{c}	16.64^{d}
Daily feed intake (g/day)	69.65	66.23	67.86	68.9
Feed gain ratio	2.33±0.002^{d}	2.52±0.063^{c}	3.27±0.027^{b}	4.04±0.111^{a}
Dressing weight (g)	1132.28^{a}	945.40^{b}	727.12^{c}	560.30^{d}
Dressing percentage (%)	71.21	67.53	64.92	61.57
Protein efficiency ratio	2.94	3.01	2.96	2.64
Nitrogen retention (%)	66.04	64.85	67.7	63.05
Dry matter digestibility (%)	71.53	72.35	72.87	69.36
Crude protein digestibility (%)	32.98	37.09	41	37.51

^{abcd} Mean on the same row with different superscripts are significantly different (P<0.05)

Organ characteristics: At the end of the experimental period, three birds per replicate (bird/treatment) were randomly selected, tagged, fasted for about 18h to empty their gastro-intestinal tract, weighed individually, slaughtered by cutting the jugular vein. The birds were scalded, plucked and weighed again before evisceration. Weights of the following organs liver, gizzard, kidney, heart, lungs, proventiculus, pancreas and spleen were taking using sensitive weighing balance.

Chemical analysis: The gross energy (GE) of the KPHM and the experimental diets were determined with Adiabatic Bomb Calorimeter. While Metabolisable energy (ME) value was calculated using the method 37x %CP + 81x %Fat +35.5 x %NFE (Fisher and Boorman, 1986).

Statistical analysis: All data collected were subjected to analysis of variance (ANOVA) according to the procedure described by Steel and Torrie, (1980). The treatment means were separated at 5% level of probability, using Duncan's Multiple Range Test (Gomez and Gomez, 1983).

Results and Discussion

The proximate composition of the compounded ration and that of Kola Pod Husk Meal (KPHM) are as shown in Table 3. The KPHM appears to be low in crude protein (9.98%), slightly high in fibre 16.74 %, moderate NFE 42.39 % and metabolizable energy 2497 kcal/kg. The ash content is relatively high 13.26% when compared with the values reported by Oluokun and Olalokun, (1999) and Hamzat and Babatunde (2001). These differences might be due to varietal differences and shelf life of the test ingredients before analysis.

However the crude protein content fairly put KPHM with feed ingredients like sorghum while the fibre content puts it in same proximate composition with Brewers grains.

The proximate composition of the starter and finisher diets falls within the recommendation of NRC 1994. The performance of broilers fed graded levels of KPHM is presented in Table 4. The final live weight, total weight gain and daily weight gain decreases significantly (P<0.05) as the level of KPHM increases. Birds fed 0 % KPHM (control) had the highest weight gain while the least weight gain was observed in the birds having 30 % KPHM inclusion meaning that the higher levels of KHM adversely affected growth. The increasing level of crude fibre in the diet as the percentage inclusion of KPHM increases may be the incriminating factor. This agrees with the report of Savory and Gentle (1976a,b) that birds on high fibre diets tend to weigh less than those on low fibre diets.

The daily feed intake observed in the entire group reflects a non-significant (P>0.05) difference between the birds on the control diet and those on diets containing the test ingredient, although the control group had a numerically higher values than the groups fed with diets containing KPHM. Earlier, Bate-Smith, (1973) had reported that presence of tannin in KPHM provokes an

Table 6: Effect of graded levels of Kola Pod Husk Meal (KPHM) on organ weights (Percentage of Live weight) of broiler chicken at 8 Weeks

Parameters	0% KPHM	10% KPHM	20% KPHM	30% KPHM
Liver weight (g)	42.98±3.86[a]	40.50±2.28[a]	32.68±2.14[b]	32.35±33.33[b]
Lung weight (g)	9.62±0.61[a]	8.68±0.51[a]	6.82±0.29[b]	5.88±0.39[b]
Heart weight (g)	8.62±0.65[a]	6.33±0.43[b]	5.35±0.35[b]	5.10±0.20[b]
Gizzard weight (g)	65.53±1.92[a]	61.58±2.43[a]	49.48±2..58[b]	45.03±2.64[b]
Pancreas weight (g)	3.97±0.41	3.10±0.31	3.60±0.42	3.38±0.43
Proventiculus wt (g)	10.23±1.16[a]	9.82±0.88[a]	8.00±0.39[b]	8.10±0.49[b]
Kidney weight (g)	8.88±0.89[a]	8.35±0.52[a]	6.52±0.40[b]	6.63±0.39[b]
Spleen weight (g)	1.47±0.11[a]	1.67±0.15[a]	1.23±0.95[b]	1.10±0.13

[bab] Mean on the same row with different superscripts are significantly different (P<0.05)

astringent reaction in mouth of the birds thereby reducing the intake of KPHM feed. The result obtained here contradicts the reports of Savory and Gentle (1976a, 1976b) who observed in Japanese quail that increase dietary fibre caused increased feed intake.

The result of the feed to gain ratio showed that significant (P<0.05) differences existed among the treatment groups. Broilers on the control diet were most efficient in the utilization of feed. It was observed also that as the level of KPHM increases, the efficiency of feed utilization decreases. The results obtained in this study agreed with the reports of Oluokun and Olalokun (1999), that KPHM depressed nutrient utilization in monogastric animal by impairing digestion and absorption of nutrients.

The protein efficiency ratio, nitrogen retention percentage as well as dry matter and crude fibre digestibility shows no significant differences among the treatments. The results obtained here contradict the reports of Oluokun and Olalokun (1999), that KPHM depressed nutrient utilization in monogastric animals. The results in the study did agreed with the findings of Babatunde and Hamzat (2005), where KPHM was fed to Cockerels.

The weights of the Liver, Lungs, Gizzard, Proventiculus, Kidney and Spleen of broilers fed the control diet and 10 % KPHM were similar but significantly (P<0.05) different from broilers fed 20 % and 30 % KPHM which were similar also. The observed decrease in weight of these organs as the level of inclusion of KPHM increases might be due to presence of Colatin and tannin in KPHM which had earlier been reported to produce depressive effect on growth rate (Opeke, 1987, Babatunde *et al.*, 2001). The values obtained for gazzard weights reflect a decreasing trend as the percentage inclusion of KPHM and by implication the fibre increases. This result did not agree with the finding of Deaton *et al.* (1973) who reported that as dietary fibre increases, gizzard weight increased. The pancreas weights were not significantly (P>0.05) different among the treatments, this may be due to the fact that the inclusion levels did not reach the threshold level that could have affected the pancreas. However, the heart weight of the broilers on control diet was significantly (P<0.05) higher than broiler fed diets containing the KPHM. This may be due to the presence of anti nutritional factor present in the KPHM.

Conclusion: The result of this study shows that as low as 10 % inclusion of KPHM in broiler diet will adversely affect performance. Consequently 10% inclusion of Kola Pod Husk Meal (KPHM) in broiler diet both at starter and finisher phases cannot support good performance of broiler chicken; perhaps a reduced level may give a contrary result.

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