PERFORMANCE OF BROILERS AS AFFECTED BY DIETS WITH OR WITHOUT COOKED RUBBER SEED OR PALM KERNEL CAKE

***[1]Lalabe, B.C., [2]Olomu, J.O., [1]Yustus, S.F., [1]Ocheja, J.O. and [1]Okpanachi, U.**

[1]Department of Animal Production, Kogi State University, Anyigba, Nigeria.
[2]Department of Animal Sciences, University of Benin, Benin City, Nigeria.

**Corresponding author:* lalabecham2020@yahoo.com

ABSTRACT

One hundred and twenty broiler chicks were used to evaluate the effects of replacing 15% maize with equal portion of cooked full fat rubber seed (CFFRS) or palm kernel cake (PKC) on performance and nutrient retention of the birds at the starter and finisher phases. Three dietary treatments (Diets 1, 2 and 3) were tested. In diets 2 and 3, 15% maize was replaced with 15% CFFRS and PKC (w/w), respectively at the starter and finisher phases. Diet 1 without CFFRS or PKC served as the control. Body weight gain, feed intake and protein efficiency ratio (PER) were depressed ($p < 0.05$) at the two growth stages. The least feed: gain ratio was obtained for birds on treatment 1 at both stages of growth. Broilers on diet 2 had the highest feed: gain ratio at the starter phase whereas it increased significantly ($p < 0.05$) from treatments 1 to 3 at the finisher stage. Substitution with PKC was superior ($p < 0.05$) to CFFRS in terms of weight gain (at starter stage) and feed intake (at starter and finisher stages). Water intake was unaffected ($p > 0.05$) in starter chicks, but its consumption increased among the finishers ($p < 0.05$) for CFFRS and PKC-based diets. Nutrient retention for protein was higher ($p < 0.05$) for birds fed control diets than those on test diets. Cost of feed per kg and the cost of feed per kg weight gain decreased significantly ($p < 0.05$) for birds fed CFFRS and PKC-based diets than those on control diet. No detrimental effect on health was noticed in birds fed CFFRS or PKC substituted diets.
Poultry farmers can safely replace 15% maize with CFFRS or PKC at a reduced cost in broilers diets at both starter and finisher stages of growth without any adverse effect on their performance characteristics.

Key words: Cooked full fat rubber seed, Palm kernel cake, Performance traits, Nutrient retention.

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INTRODUCTION

Deliberate research efforts are being deployed to overcome the problem of scarcity of feed ingredients in poultry industry in order to provide sufficient animal protein to meet the ever increasing demand in Nigeria. Feed represents between 60 to 80% of the recurrent cost in poultry production (Olomu, 1995) and broiler production is specifically constrained by insufficient availability and high cost of feed. The supply deficit in conventional feed ingredients partly arises from apparent competition for food

consumption between livestock and humans leading to escalated cost of poultry products often beyond the reach of the average consumer. Maize is a major conventional source of energy in poultry diet constituting between 50 to 70% (PAN, 1985). It also serves as the major staple foodstuff for many Nigerians. There is perceptible demand pressure on maize by humans, livestock and industry. Evaluation of alternative feedstuff becomes most eligible solution to these contradictions. A number of non-conventional feed ingredients emanating from research are being adopted on account of their low cost, and large volume of supply from the immediate local environment. In most cases the alternative feed stuff are free from the pressure of competition by humans and industry (Sapcota, 1992).

Rubber seed and Palm kernel are non conventional feed ingredients that are readily available in the southern part of Nigeria where poultry production is widespread. There are indications that rubber seed is a potential feed ingredient which has received little attention for its adoption (Achinewhu, 1982). The full fat rubber seed contains between 43 to 49% ether extract, and a crude protein level of 28 to 38% after its oil extraction (Nwokolo and Akpakunam, 1985; Oluyemi *et. al.*, 1975; Orok and Bowland, 1974). The extracted rubber seed oil contains 18.90% saturated and 81.10% unsaturated fatty acids (Achinewhu, 1985). Rubber seed is reported to have metabolisable energy values of between 4338 and 4693 kcal/kg for chicks (Oluyemi *et al.*, 1975). However the presence of toxic substances such as hydrocyanide and saponins in rubber seed has been reported to negate efficient performance of broiler chicks (Nwokolo, *et.al*.1987). Palm kernel cake (PKC), in contrast, is reported to have comparatively lower nutritive value, which full fat rubber seed may complement to enhance growth performance and profitability of broiler production in the zone where the seed has higher production advantage (Olomu, 1995).

The objective of this study was to compare the feeding values of cooked full fat rubber seed and palm kernel cake in broiler chick production at the starter and finisher phases.

MATERIALS AND METHODS

Location: The experiment was conducted at the Livestock Unit of Rubber Research Institute of Nigeria, Benin City (6° 02′ N and 5° 06′ E). Benin City is a metropolitan urban centre located in the humid rain forest zone of Nigeria.

Processing of full fat rubber seed: Full Fat Rubber Seeds (FFRS) were obtained from the rubber plantation of Rubber Research Institute of Nigeria, Benin City. The seeds were de-shelled and boiled in water at 100^0C for 30 minutes to produce Cooked Full Fat Rubber Seed (CFFRS). It was then sun dried to a constant weight, milled and incorporated into the diet. The Palm Kernel Cake (PKC) used was purchased from a local feed mill in Benin City.

Preparation of experimental Diets: The gross composition of the dietary treatments for broiler starter and finisher chicks are presented in Table 1. The control diet at starter stage was compounded to contain 22.45% Crude Protein (CP) and 2977 Kcal/Kg Metabolisable Energy (ME). In diets 2 and 3, 15% maize was replaced with CFFRS meal and PKC gravimetrically (w/w) respectively and the diets contained 23.65 and 24.32% CP; and 3182 and 2825 kcalME/kg in that order. The levels of other ingredients however remained the same in all the diets as there was no

attempt to make the diets isonitrogenous or isocaloric. The birds were fed starter diet for 5 weeks. The control diet at finisher phase contained 19.43% CP and 2860 Kcal/Kg ME. The CFFRS meal and PKC were also used to replace 15% maize (w/w) in diets 2 and 3 respectively in the finisher diets and the levels of other ingredients in the diets remain the same all through. Diets 2 and 3 at the finisher phase contained 20.63 and 21.31%CP respectively; and 3065 and 2709kcalME/kg in that order. The finisher phase lasted for three weeks.

Table 1: Percentage composition of broiler diets with cooked full fat rubber seed or palm kernel cake

	Starter phase			**Finisher phase**		
Diets	**1**	**2**	**3**	**1**	**2**	**3**
	Control	**CFFRS**	**PKC**	**Control**	**CFFRS**	**PKC**
Ingredients :						
Maize	60.00	45.00	45.00	60.00	45.00	45.00
Soya bean meal	35.40	35.40	35.40	26.00	26.00	26.00
Wheat offal	--	--	--	10.00	10.00	10.00
Cooked FFRS	--	15.00	--	--	15.00	--
Palm kernel cake	--	--	15.00	--	--	15.00
Bone meal	2.80	2.80	2.80	2.00	2.00	2.00
Oyster shell	1.00	1.00	1.00	1.20	1.20	1.20
Table salt	0.35	0.35	0.35	0.35	0.35	0.35
*Premix	0.25	0.25	0.25	0.25	0.25	0.25
DL-Methionine	0.10	0.10	0.10	0.10	0.10	0.10
L-Lysine	0.10	0.10	0.10	0.10	0.10	0.10
Total	100.00	100.00	100.00	100.00	100.00	100.00
Calculated values						
Crude protein (%)	22.45	23.65	24.32	19.43	20.63	21.31
ME (Kcal/kg	2977	3182	2825	2860	3065	2709
Crude fat (%)	2.99	9.32	3.55	3.19	9.57	3.75
Crude fibre (%)	2.71	2.92	5.02	3.33	3.53	5.64
Calcium (%)	1.30	1.30	1.35	1.11	1.12	1.17
Phosphorus (%)	0.86	0.92	0.89	0.74	0.80	0.78
Lysine (%)	1.44	1.93	1.50	1.20	1.70	1.30
Methionine + Cystine (%)	0.77	1.93	0.74	0.85	0.80	0.68

CFFRS = Cooked Full Fat Rubber Seed; PKC = Palm Kernel Cake; ME = Metabolizable Energy.

*Supplied per kg diet; vit. A, 10,000 IU; vit. D_3, 2000 ICU; vit. E, 40mg; vit. K_3, 2mg; vit. B_1, 2.4mg; vit. B_2, 4.8mg; Niacin, 32mg; vit. B_6, 4.8mg; Pantothenic acid, 8mg; Biotin, 0.1mg; vit. B_{12}, 0.02mg; Folic acid, 0.08mg; Iron, 40mg; Zinc, 36mg; Copper, 1.6mg; Choline Chloride, 240mg; Manganese, 80mg; Iodine, 1.24mg; Cobalt, 0.2mg; and Selenium, 0.1mg.

Management and Feeding of Experimental Birds: One hundred and twenty broiler chicks were brooded and managed in a battery cage system installed in an open-sided poultry house. During the brooding period, the open sides of the house were covered with plastic sheets and adequate warmth was provided using 200 watts electric bulbs. The birds were vaccinated according to schedule. Coccidiostat was given at intervals of 2 to 3 weeks while prophylactic dose of antibiotics were administered at regular intervals in water

to prevent infections. At the commencement of the experiment, 120 day-old chicks were weighed and randomly allocated to three dietary treatments of four replicates each with 10 birds per replicate in a Completely Randomized Design (CRD). Feed and water were supplied *ad libitum*. The birds were weighed, and feed consumption was recorded at weekly intervals. Daily water intake was determined for each group of birds throughout the experimental period. Chicks were observed daily and a record of mortality was kept.

At the end of the starter period (5 weeks), 3 birds were randomly picked from each of the replicates for metabolic study to evaluate the nutrient utilization. Measured quantities of the experimental diets were fed to the birds according to treatments. Feed and water were provided *ad libitum*. Feed intake was measured. The total faecal droppings per replicate were collected for 3 days at 24 hour intervals, weighed, labelled and oven dried at 105ºC to a constant weight to determine the moisture content. The 3-day faecal collection for each replicate was bulked and finely ground to obtain a homogenous mixture and the representative samples of feed and droppings were subjected to proximate analysis using the standard procedures of AOAC (1990). Percentage nutrient retention was determined from the results of the proximate composition of the feed and droppings.

The experimental data collected on performance and nutrient retention at starter and finisher phases were subjected to analysis of variance (ANOVA) using SAS, (1999) and the means were separated using the Least Significant Difference test ($p = 0.05$).

RESULTS

The performance characteristics of boilers fed CFFRS and PKC as partial replacement for maize is as shown in Table 2. The results showed a significant ($p < 0.05$) decrease in body weight gain when 15% maize was replaced with either cooked FFRS or PKC at both levels of broiler production. Birds fed PKC based diets however gained ($p < 0.05$) more than birds fed CFFRS in the starter phase but both were similar ($p > 0.05$) at the finisher stage. Feed intake decreased significantly ($p < 0.05$) for birds fed CFFRS based diet than birds fed the control and PKC based diet in the starter phase. For the finisher phase, birds fed PKC based diets recorded significantly ($p < 0.05$) higher intake and birds fed CFFRS recorded significantly ($p < 0.05$) lower intake than birds fed the control diet. Feed to gain ratio increased significantly ($p < 0.05$) when 15% of the dietary maize in the control diet was replaced with either CFFRS or PKC at the starter phase. Birds fed CFFRS or PKC gave higher or poorer feed conversion than birds fed control diet at either growth stages. Daily water consumption obtained for birds fed PKC based diet was higher ($p < 0.05$) than those on control and CFFRS based diets at the finisher stage. Feed cost per bird and feed cost per kg live weight gain decreased significantly ($p < 0.05$) when CFFRS and PKC were used to replace maize in diets 2 and 3.

Replacing 15% maize with CFFRS and PKC did not affect daily water intake per bird at the starter stage. The feed cost per bird significantly ($p < 0.05$) decreased from ₦149.05 in diet 1(control) to ₦134.87 and ₦134.01 for birds fed CFFRS and PKC respectively. The feed cost per kg weight gain correspondingly followed the same pattern as the feed cost

per bird were better and similar for diets 2 and 3 than maize based diet 1.

Table 2: Performance characteristics of broilers fed cooked full fat rubber seed or palm kernel cake as partial replacement for maize

	Starter Phase				Finisher Phase			
Diets	**1**	**2**	**3**		**1**	**2**	**3**	
Test Ingredient	**Control**	**CFFRS**	**PKC**		**Control**	**CFFRS**	**PKC**	
Level (%)	**0**	**15**	**15**	**SEM**	**0**	**15**	**15**	**SEM**
Parameters:								
Feed intake (g/bird)	1792.0[a]	1743.9[b]	1778.3[a]	24.00	3248.4[b]	3097.7[c]	3295.6[a]	47.03
Water intake (ml/bird/day)	131.30	131.90	136.50	2.84	336.13[b]	355.66[a]	358.88[a]	2.84
WG (g/bird)	974.90[a]	872.40[c]	929.80[b]	8.60	1114.30[a]	1069.75[b]	1078.13[b]	9.28
Feed : Gain	1.84[c]	2.00[a]	1.91[b]	0.02	2.92[b]	2.93[b]	3.05[a]	0.05
PER	0.95[a]	0.67[b]	0.68[b]	0.10	0.48	0.38	0.36	0.10
CFC(₦ /bird)	92.71[a]	78.15[b]	78.94[b]	1.19	149.05[a]	134.87[b]	134.01[b]	1.98
Feed Cost/kgLWG (₦)	95.10[a]	89.70[b]	84.90[c]	2.84	133.76[a]	127.39[b]	124.30[c]	1.98

[abc]Means within row with different superscript are significantly ($p < 0.05$) different.
CFFRS = Cooked full fat Rubber seed; PKC = Palm Kernel Cake; SEM = Standard Error of Mean; WG = Weight Gain; PER = Protein Efficiency Ratio; CFC = Cost of Feed Consumed; LWG = Live Weight Gain.

The results of the nutrient retention are presented in Table 3. Birds fed control diet retained more ($p < 0.05$) crude protein, ash and nitrogen free extract than birds fed CFFRS and PKC based diets. Birds fed CFFRS-based diet had higher ($p < 0.05$) retention values for ether extract and NFE than those fed PKC-based diets. The crude protein and ash retention were similar for birds fed CFFRS or PKC-based diets.

Table 3: Nutrient retention of broiler chicks (1-5weeks old) fed cooked full fat rubber seed and palm kernel cake-based diets

Diets	**1**	**2**	**3**	
	Control	**15% CFFRS**	**15% PKC**	**SEM**
Parameters (%):				
Crude protein	70.11[a]	65.44[b]	64.83[b]	0.41
Ether extracts	59.25[c]	70.23[a]	62.45[b]	0.62
Ash	66.45[a]	61.36[b]	63.32[b]	0.63
Nitrogen Free Extract	82.11[a]	78.63[b]	73.53[c]	0.85

[abc]Means within row with different superscript are significantly ($p < 0.05$) different.
CFFRS = Cooked full fat Rubber seed; PKC = Palm kernel cake; SEM = Standard Error of Mean.

DISCUSSION

The decreased weight gain observed in birds fed CFFRS and PKC at the starter phase, despite their high levels of crude protein, lysine and methionine, can be attributed to the relatively low availability of nutrients in the CFFRS and PKC portions of the diets. (Nwokolo, 1985 and Yeong, 1983). The relative better weight gain and feed to gain ratio in the control diet may be attributed to the higher utilization and hence higher retention of nutrients in the diet. The increase in feed intake observed with birds fed PKC base diet compared to birds fed CFFRS could be due to low energy and high fibre level of the diets in both the starter and finisher stages. This agrees with the report of Ezieshi and Olomu (2004) who reported higher feed intake for birds fed diets containing PKC as birds are apt to consume more feed in order to get more dietary energy to meet physiological needs. The birds fed PKC-based diets gained more than birds fed CFFRS despite the similarity in their protein and energy levels. Incomplete inactivation of intrinsic anti-nutritional factors in CFFRS is suspected. It is also possibly suspected that the process of inactivation could render nutrients unutilized for growth but for fat deposit. Birds fed CFFRS diet consumed less feed due to higher dietary energy and retained more nutrients than birds fed PKC. Pesti (1982) reported an inverse relationship between the level of metabolizable energy in a diet and the feed intake.

It is quite clear that birds fed PKC gained more than those fed CFFRS possibly because inactivated anti-nutritional factors negate availability and utilization of nutrients in CFFRS. This conforms to the report of Elkin *et al*., (1995), that anti-nutritional factors reduce growth rate of broiler due to reduced protein and specific amino acid utilization. The higher daily water intake recorded for birds fed PKC diets could be due to the high fibre content of the PKC portion of the diet. Chin (2002) observed the same phenomenon and suggested that higher intake of water could be a physiological means by which broiler finisher tolerate or cope with high dietary fibre.

The lower cost of PKC (₦11.00 per kg) and FFRS (₦16.00 per kg) as at the time the study was carried out was responsible for the decreased cost of feeding in the PKC and CFFRS-based diets than the control diets at both the starter and finisher phases. Dafwang (2009) has shown that low cost is a major attribute which the non conventional feedstuff have over the conventional feed ingredients. That also informs their widespread usage and adoption in poultry production.

CONCLUSION AND RECOMMENDATION

- Cooked full fat rubber seed and palm kernel cake can equally replace maize at 15% in broiler diets without much adverse effect on broiler performance and at a lower cost of production.
- There is the need to further investigate the effects of anti-nutritional factors in cooked full fat rubber seed and its incorporation into broiler diets in place of maize.

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