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Performance characteristics and digestibility status of broilers, fed with graded levels of cowpea testa meal based diet

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Abstract

Performance of poultry production have been hindered due to exorbitant rise in price of essential fed stuff, which calls for incorporation of household wastes like cowpea testa meal (CTM), in broiler diet as a partial replacement for expensive soybean meal, which is relatively cheaper and readily available. 120 birds were allotted randomly into four dietary groups; having CTM replacing soybeans meal, T1 contain 0%, T2 have 15%, T3 contain 30%, and T4 have 50% graded levels of CTM for 56 days. At exactly 7 days of experiment termination, 5 birds per replicate were isolated in digestibility cage for faecal analysis while performance characteristics were also evaluated in a completely randomized design. Shows that T1 (1062.88g) and T2 (1057.50g) perform best significantly ($P<0.05$) for average final weight than T3 (810.36g) and T4 (738.75g). Average weight gain follows same trend as average final weight gain. T1 and T2 had lowest Feed Conversion Ratio with (6.00 and 6.26) than T3 and T4 with (8.04 and 8.63) respectively. Costs of producing feeds for all diets were the same for both starter and finisher diet. Digestibility studies show that T1 and T2 have the highest significant values for protein (10.10%, 8.70%) than for T3 and T4 with (7.80% and 7.10%) the same trend were observed for the ash content. T2 at 15% inclusion of Cowpea testa meal perform best than T3 at 30 % and T4 at 50% in all parameters evaluated.

Keywords: Cowpea Testa Meal; Performance Characteristics; Digestibility Status; Broiler

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1. Introduction

The sustainability and productivity of livestock depend on their feed which ranges from 65-75% of the total production input cost in intensive animal production (Oruwari et al., 1998). Poultry has ability to convert grain and crop residues into meat and egg within a short period of time providing protein need of man (Akinmutimi and Onwukwe, 2002), which is on a scale of 10g protein intake per day, compared to the daily recommended protein intake of 35g (FAO, 1997) and this calls for the increase in the production of livestock especially poultry as an animal protein source (Ani and Omoje, 2004). Broiler production is one of the fastest means of increasing animal protein intake for the populace since their growth is very fast compared with local broiler birds (FAO, 2008), having short generation interval of 8 weeks and above, high level of growth, with the best efficiency rate of nutrient conversion into high-quality protein. Its productivity has been hindered by the exorbitant prices and competition that exist between human and livestock for grain-based feedstuffs which have made the price of conventional protein feedstuff like soybean unpredictable. Integration of unconventional feedstuff for the conventional ones remain the only solution to the cost of production in broiler production and there are array of promising non-conventional feed resources throughout Nigeria and like the conventional feed resources they also supply energy, protein, fat and minerals to the diet of livestock, example of these unconventional feedstuffs are rice bran, cowpea testa meal. Cowpea testa meal is a protein supplying unconventional feed resource that is relatively cheap compared to soybean meal and other protein source feed materials, with crude protein of 17% and a calculated metabolizable energy of 1005g cal / kg dry matter (Alabi, et al., 2010). Integrating cowpea testa meal (CTM) with soybean meal in broiler starter and finisher phase could help increase animal protein available throughout the season and decrease environmental pollution caused by the unused cowpea testa. The study will therefore focus on performance results of broilers birds fed with compounded feed containing cowpea testa meal in replacement for soybean meal, in their diets.

2. Materials and methods

This research was conducted at the poultry unit in the Teaching and Research Farm, Department of Animal Science, College of Agriculture, Ejigbo Campus, Osun State University, Osun state. The climate of this experiment site is humid and it is located in the derived savannah zone of Western Nigeria. The mean annual rainfall and temperature of the farm where the experiment took place are 1,200mm and 26.5^{o}C respectively having annual relative humidity throughout the year. The farm is located on latitude 7^{0}54N and longitude 4^{0}18E and 4^{0}54E at an altitude of 426m above the sea level. Ejigbo is located in the middle position of 35km to the North East of Iwo, 30km from Ogbomoso in the North and about 24km east. Usually, the rain season lasts from April to October

2.1. Management of experimental animal

'*Arbor acre*' broiler day-old chicks of one hundred and twenty pieces were purchased from a reputable hatchery in Ibadan, Oyo State. Immediately after arrival, they were given ant – stress (water containing

glucose), and antibiotics for five days. The birds were randomly allocated into 4 treatments, having 30 birds per treatment and 3 replicates of 10 birds per replicate. Brooding was done with charcoal pots and kerosene lantern on a deep litter for 3 weeks. They were fed with compounded broiler starter diet for 4 weeks and compounded broiler finisher diets for the remaining 4weeks. Cowpea testa meal (CTM) was used to instead of soybean meal at 0%, 15%, 30% and 50% graded level on weight basis (Tables 1 and 2). They were house in ventilated demarcated deep litter system.

2.2. Cost analysis

The costs of the various feed ingredients were estimated and compared with the performance of the birds in term of weight and cost of feed intake per kilogramme of weight gain to determine the cost implication of feeding broilers with cowpea testa meal. The cost of individual ingredients in each kg of the concentrate supplement is shown in Table 3a and 3b.

2.3. Experimental diets

The birds were subjected to four experimental diets which are: T1 with (0% CTM), T2 with (15% CTM), T3 with (30% CTM) and T4 with (50% CTM).

Table 1. Gross composition of broiler starter experimental diets

Ingredients	**T1 (0% CTM)**	**T2 (15% CTM)**	**T3 (30%CTM)**	**T4 (50%CTM)**
Maize	57.00	57.00	57.00	57.00
Soyabeanmeal	35.00	29.75	24.50	17.50
Cowpea testa meal	-	5.25	10.50	17.50
Fish meal 72%	4.00	4.00	4.00	4.00
Limestone	1.30	1.30	1.30	1.30
Bone meal/DCP	1.38	1.38	1.38	1.38
Broiler starter Premix	0.35	0.35	0.35	0.35
Salt	0.30	0.30	0.30	0.30
Methionine	0.10	0.10	0.10	0.10
Lysine	0.10	0.10	0.10	0.10
Total	**100.00**	**100.00**	**100.00**	**100.00**

Table 1. *Cont.*

Ingredients	T1 (0% CTM)	T2 (15% CTM)	T3 (30%CTM)	T4 (50%CTM)
Calculated value of crude protein (%)	23.98	22.56	21.15	19.26
Metabolizable energy (kcal/kg)	3039.70	2945.46	2851.23	2725.58
Calcium	0.97	0.96	0.95	0.93
Phosphorus	0.39	0.42	0.45	0.49

2.4. Performance characteristics

The initial weight of birds were taken before being allotted into treatments and data on initial body weight, weekly feed consumption, body weight changes were collected during the experiment weekly weight change and feed efficiency ratio were determined on weekly basis. The birds were given a know kg of feed in the morning and the left-over were weigh in the evening and recorded.

I. Weight Gain (g)

The initial body weight of the chicks was taken while subsequent body weight was recorded twice a week.

$$\text{Weight Gain} = \text{final weight} - \text{initial weight}$$

II. Feed Intake (g)

A known quantity of feed was given to chicks, while leftover of feed was weighed to evaluate the feed intake taken daily and consequent weekly feed consumption intake.

This was calculated by

$$FI = \frac{FS - LF}{NC}$$

where; F.I = Feed intake per bird, LF = Left Over feed, NC = Number of chicks (in the replicate).

III. Feed Conversion Ratio (FCR)

These chicks were determined by calculating the ratio of feed intake to weight gain as:

$$(FCR) = \frac{\text{Total feed consumption intake (g) after 8 weeks}}{\text{Total body weight gain, after 8 weeks}}$$

At 8th weeks birds were selected at random from each replicate and housed in an individual cage for digestibility studies, while the faecal sample from the digestibility cage was a weight for proximate analysis as described by (A.O.A.C, 2005) for digestibility studies.

Table 2. Gross composition of broiler finisher experimental diets

Ingredients	**T1(0%CTM)**	**T2(15% CTM)**	**T3(30%CTM)**	**T4(50%CTM**
Maize	60.00	60.00	60.00	60.00
Soyabean meal	25.00	21.25	17.50	12.50
Cowpea testa meal	-	3.75	7.50	12.50
Palm Kernel Cake	4.00	4.00	4.00	4.00
Wheat Offal	7.00	7.00	7.00	7.00
Bone meal/DCP	2.00	2.00	2.00	2.00
Broiler finisher Premix	0.35	0.35	0.35	0.35
Salt	0.35	0.35	0.35	0.35
Methionine	0.10	0.10	0.10	0.10
Lysine	0.10	0.10	0.10	0.10
Total	**100.00**	**100.00**	**100.00**	**100.00**
Calculated value of crude protein(%)	18.75	17.94	16.93	15.58
Metabolizable energy (kcal/kg).	3008.00	2940.69	2873.38	2783.63
Calcium	0.98	0.97	0.96	0.95
Phosphorus	0.40	0.42	0.44	0.47

2.5. Statistical analysis

Data were analyzed using SAS (1999) software while means with significant difference among the treatments were separated using the Duncan's (1955) option of the same software.

3. Results

Table 3a. Cost of feed ingredients (₦) per kilogram of broiler diets compounded at starter phase

	T1	**T1**	**T1**	**T4**
Ingredients	**(0% CTM)**	**(15% CTM)**	**(30% CTM)**	**(50% CTM)**
Maize	39.90	39.90	39.90	39.90

Table 3a. *Cont.*

	T1	T1	T1	T4
Soya bean meal	49.00	41.65	34.30	24.50
CTM	0.00	2.63	5.25	8.75
Fish	24.00	24.00	24.00	24.00
Limestone	0.33	0.33	0.33	0.33
Bone meal	0.69	0.69	0.69	0.69
Broiler starter Premix	1.58	1.58	1.58	1.58
Salt	0.18	0.18	0.18	0.18
Methionine	1.50	1.50	1.50	1.50
Lysine	0.80	0.80	0.80	0.80
Total	120.90	113.26	106.95	102.23

Table 3b. Cost of feed ingredients (₦) per kilogram of broiler diets compounded at finisher phase

	T1	T2	T3	T4
Ingredients	**(0% CTM)**	**(15% CTM)**	**(30% CTM)**	**(50% CTM)**
Maize	42.00	42.00	42.00	42.00
Soya bean meal	35.00	29.75	24.50	17.50
CTM	0.00	1.88	3.75	6.25
PKC	1.40	1.40	1.40	1.40
Wheat Offal	3.92	3.92	3.92	3.92
Limestone	0.28	0.28	0.28	0.28
Bone meal	1.00	1.00	1.00	1.00
Broiler finisher Premix	1.54	1.54	1.54	1.54
Salt	0.21	0.21	0.21	0.21
Methionine	1.50	1.50	1.50	1.50
Lysine	0.80	0.80	0.80	0.80
Total	87.65	84.28	80.90	75.77

Cost of individual ingredients in 1kg concentrate diet is shown in Table 3a and b. Cost per kilogram of cowpea testa meal was estimated on transportation and labour cost.

Table 4. Proximate composition of experimental diets at starter and finisher phase

Parameters		**Starter**				**Finisher**		
CTM	(0%)	(15%)	(30%)	(50%)	(0%)	(15%)	(30%)	(50%)
DM%	91.57	90.57	90.13	88.97	87.56	88.45	87.71	90.01
CP%	23.98	22.56	21.15	19.26	18.75	17.94	16.93	90.01
CF%	5.00	5.30	5.50	5.50	5.00	6.00	7.00	8.00
CA%	7.00	7.00	7.00	7.00	7.00	7.00	8.00	8.00
EE%	7.00	6.50	6.00	5.50	5.50	5.00	4.50	4.50
NFE	57.02	59.64	60.35	60.35	63.75	64.06	63.57	63.92

KEY: DM—Dry matter, CP---crude protein, CF---crude fibre, CA---crude ash, EE----ether extract, NFE---nitrogen free extract.

Table 5. Performance characteristics of broilers in response to graded level of cowpea

Traits	**T1 (0%)**	**T2 (15%)**	**T3 (30%)**	**T4 (50%)**	**SEM**
Ave. Ini. Live wt.(g)	55.00^{b}	60.00^{a}	50.00^{c}	55.00^{b}	46.68
Ave.final live wt. (g)	1062.88^{a}	1057.50^{b}	810.36^{c}	738.75^{d}	16.50
Ave. wt.gain (g/day)	18.98^{a}	18.18^{b}	14.15^{c}	13.19^{d}	14.94
Daily feedIntake (g/day)	113.90	113.92	113.82	113.82	0.58
Feed conversion Ratio	6.00^{c}	6.26^{c}	8.04^{b}	8.63^{a}	0.24

^{a,b,c} means on the same row are significantly different (P<0.05)

Table 6. Digestibility studies of broilers fed graded level of cowpea testa meal

Constituents %	**T1(0% CTM)**	**T2 (15% CTM)**	**T3 (30% CTM)**	**T4 (50%CTM)**
Protein %	10.10^{a}	8.70^{b}	7.80^{c}	7.10^{c}
Crude fibre %	2.40^{c}	2.50^{c}	2.90^{b}	3.50^{a}
Ether extract %	2.00	2.00	1.88	1.75

Table 6. *Cont.*

Constituents %	T1(0% CTM)	T2 (15% CTM)	T3 (30% CTM)	T4 (50%CTM)
Ash %	3.60[a]	3.30[a]	2.90[b]	2.50[b]
NFE	81.90	83.50	84.52	85.15
Dry matter	89.12	88.43	87.13	86.88

[a,b,c:] *Mean on the same row with different subscript are significantly different.(p<0.05)*

4. Discussion

The proximate analysis as a percentage of all the diets fed to the animal was given in Table 4. Crude protein in the starter diet ranged between 19.26% to 23.98% and these values fell within the values gotten by Aduku, (2004), who also gave a recommendation of 23.00. In this case, treatment diet with 0% and 15% CTM inclusion level meet Aduku, (2004) recommendation while the other two inclusion level 30% and 50% cowpea testa meal fall below Aduku, (2004) recommendation of broiler starter nutrient requirement. The percentage crude protein of the treatment for finisher phase ranged between 15.58% to 18.75% with no diet having an approximate value of 20% crude protein as recommended by Aduku (2004). Crude fibre increased across the diet with the finisher phase having the highest value. This may be due to the crude fiber level of cowpea testa meal (20.30%) according to (Sonaiya, 1989). He also reported cowpea testa meal to have 17.00% crude protein, 2.60% ether extract and a calculated metabolizable energy of 1005kcal/kg per dry matter.

Table 5, shows the final weight gain, feed conversion ratio of broiler fed graded level of cowpea testa inclusion in the diet. This table also summarizes the performance characteristics of broilers in response to the treatment diets. Significant ($p < 0.05$) differences were observed in daily weight and feed conversion ratio across the diet. Treatment 1 (control) had the highest average daily weight gain of (18.98g/day) followed T2 (15%) inclusion level of cowpea testa meal, while Treatment 4 with (50%) inclusion level had the lowest daily weight gain. This showed that the average daily weight gain is affected by increase level of cowpea testa meal in the feed.

The better weight gain in Treatment T1 (0%) and T2 (15%) might be connected with the result obtained from the proximate composition of the diets (Table 5) where diet 1(0% CTM) and T2 (15% CTM) had the best value for ether extract both at the starter and finisher phase. The larger value of ether extract is responsible for higher fat deposition and subsequent weight gain. Similarly, significant differences ($p<0.05$) were noticed in the feed conversion ratio of the birds across the diet. Ekut et al., (2010) also reported an increased in the feed conversion ratio value with increasing level of toasted pigeon pea inclusion in broilers and cockerel's diets respectively. The result showed that increased level of cowpea testa meal in the diet increased the values obtained for feed conversion ratio across the treatments.

It was discovered that the composition of broiler finisher diet affects the digestibility and utilization of feed constituent by broiler finisher (F.A.O, 2008). Ani and Omoje, (2004) reported, that the addition of fish meal to poultry diet increases feeds efficiency and growth leading to better digestion, absorption and utilization of amino acids. The crude protein digestibility was significantly ($p<0.05$) influenced by varying levels of CTM in the diets. The crude protein digestibility in broiler finisher diets decreased as the inclusion level of cowpea testa meal increased across the diets. This may be attributed to a low proportion of essential amino acids in a highly indigestible form particularly lysine and methionine. Another factor that could be responsible for the low digestibility across the treatment group is the availability of nutritional factor which was reported by (Sonaiya, 1989). Cowpea testa meal contains 12.4mg/g of CTM while 5.3mg/g of trypsin inhibitor is in CTM. This may make crude protein and other nutrient unavailable to the body and thereby causing undigested in the faecal sample of treatment diets.

5. Conclusion and recommendation

Cowpea testa meal could be an alternative feed resource for broiler nutrition to substitute for soybean meal up to 15% producing good effective growth performance. It could be recommended also cowpea testa meal could be used to replace or substitute soybean, because of the competition for grains by human and animal which makes livestock production expensive due to the exorbitant cost of feed ingredient especially soybean meal. Cowpea testa meal is a relatively cheaper feed ingredient than soybean which calls for the improvement of the utilization of cowpea in order to separate testa from it and make them available in feed mills for subsistence and commercial poultry farmers.

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