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Effects of Feeding *Cassia obtusifolia* Leaf Meal on Growth Performance, Carcass Characteristics and Blood Profile of Broiler Chickens

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ABSTRACT

An experiment was conducted to evaluate the effects of feeding *Cassia obtusifolia* leaf meal on growth performance and carcass characteristics of broiler Chickens. Two hundred (200) unsexed day old *Marshall* Broiler chicks were used for the study. Five diets were formulated such that *Cassia obtusifolia* leaf meal were used at 0%, 3%, 6%, 9% and 12% designated as treatments T1, T2, T3, T4 and T5 respectively. The chicks were weighed and randomly allocated to five dietary treatments replicated four times with ten birds per replicate in completely randomized design. The proximate composition of *Cassia obtusifolia* showed it contains 93.51% dry matter, 25.44% crude protein, 19.14%, crude fibre, 12.17% ash, 4.06% ether extract and 38.19% nitrogen free extract. The leaf meal also contains saponin (6.26%), phytate (2.97%), tannins (4.52%) and oxalates (2.37%). The result of growth parameters measured were significantly different (P<0.05) except, total feed intake and average daily feed intake. Similarly, live weight, plucked weight, eviscerated weight, carcass weight and dressing percentage did not show any significant difference among treatment groups. The result of the internal organs evaluated showed variation in the weights of pancreas, large and small intestines across the treatments. It was concluded from the results obtained that COLM can be included up to 9% in broiler chickens' diet without adverse effect on the growth performance, carcass and internal organs characteristics.

INTRODUCTION

High cost of conventional feedstuffs most especially protein and energy sources has been one of the major challenges of intensive poultry production in developing countries (Ani, 2008). A possible solution to the escalating cost of these ingredients is to explore the potentials of alternative feedstuffs as part of replacement for the expensive conventional feed ingredients. The alternative feedstuff considered in this study is *Cassia obtusifolia. Cassia obtusifolia* is a leguminous plant that mostly grows in the wild commonly called sickle pod, *Sicklesenna, Senna obtusifolia, c*offee weed and arsenic weed. It is mostly found in the northern part of Nigeria in areas that have not been cultivated during the rainy season. The leaves are dried and used for making soup, which is a delicacy in the study area. The seeds have been used in different forms and at times used as coffee (Ousman *et al*., 2005; Damron and Jacob, 2009). Study conducted by Ayssiwede *et al.* (2012) reported that Cassia leaves on dry matter basis contain 27.4% crude protein,16.8% crude fibre, ash 15.2%,3.8% ether extract, 36.8% nitrogen free extract and metabolizable energy of 2050.47kcal/kg. The leaves also contain some appreciable amount of calcium 3.1% and potassium 1.3%. Nuhu *et al*. (2010) observed that, *cassia obtusifolia* leaf meal contain negligible amount of tannin 4.53%, polyphenols 14.02% and phytate 31.00%. This study therefore was carried out to investigate the effect of dietary inclusion of *Cassia obtusifolia* leaf meal in broiler production.

MATERIALS AND METHODS

Experimental site

The study was conducted at the Poultry Unit Teaching and Research Farm of the Department of Animal Science and Range Management, Modibbo Adama University of Technology Yola. Yola lies between latitude 7º and 11ºN and longitude 11º and 14ºE. Maximum temperature in the state can reach up to 40ºC particularly in April, while minimum temperature can be as low as 18ºC between December and January (Adebayo, 1999).

Processing of *Cassia obtusifolia*

Cassia obtusifolia leaves were collected around the study area. The leaves were left to sun dry on a concrete floor for 3-4 days until they are crispy to touch while still retaining the greenish coloration. The leaves were milled into fine powder using milling machine.

Experimental Diets, experimental design and management

The diets were formulated such that *Cassia obtusifolia* leaves were used at 0%, 3%, 6%, 9% and 12% to represent treatments T_1, T_2, T_3, T_4 and T_5 respectively as shown in Tables1 and 2 for both starter and finisher diets. Two hundred (200) unsexed day old *Marshall* broiler chicks procured from Otta Farms Ltd, Ibadan, Oyo State, Nigeria. They were brooded for one week on commercial starter diet, and were randomly allocated to five dietary treatments of four replicates with ten birds per replicate in completely randomised designed. The birds were managed on a deep litter system throughout the experimental period. Routine management practices were observed as recommended by Oluyemi and Robert,(2000). The experiment lasted for 8 weeks.

Table 1: Percentage Composition of Broiler Starter Diets

	Dietary treatments				
Ingredients	T1	T2	T3	T4	T5
Maize	41.00	41.00	41.00	41.00	41.00
Soya beans	38.00	36.00	34.00	33.00	31.00
Cassia obtusifolia	0.00	3.00	6.00	9.00	12.00
Wheat Offal	12.00	11.00	10.00	8.00	7.00
Fish meal	2.00	2.00	2.00	2.00	2.00
Groundnut cake	3.70	3.70	3.70	3.70	3.70
Bone meal	2.50	2.50	2.50	2.50	2.50
Premix*	0.25	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25	0.25
Methionine	0.20	0.20	0.20	0.20	0.20
Lysine	0.10	0.10	0.10	0.10	0.10
Total	100	100	100	100	100
Calculated Analysis					
Crude protein	23.00	23.00	23.00	23.00	23.00
Crude fibre	4.10	4.30	4.70	5.00	5.50
Calcium	1.00	1.10	1.20	1.30	1.40
Phosphorus	0.60	0.60	0.70	0.70	0.70
Methionine	0.50	0.50	0.50	0.50	0.50
Lysine	1.30	1.30	1.20	1.20	1.10
ME(Kcal/Kg)	2956	2937	2917	2911	2929

*Vitamin- Mineral premix (Bio-mix) provided per kg include the following: Vitamin A 500 IU; Vitamin D_3, 888,000 iu; Vitamin E, 12,200mg; Vitamin K_3 15,000mg; Vitamin B_1, 100mg; B_2, 200mg; B_6, 1500mg; Niacin, 1200mg; Pathothenic acid, 2000mg; Biotic, 100mg; Vitamin B_{12}, 3000mg; Folic acid, 1500mg; Chlorine chloride, 60,000mg; Manganese, 10,000mg; Iron, 1500mg; Zinc, 800mg; Copper, 400mg; Iodine, 80mg; Cobalt, 40mg; Selenium, 8000mg.

Table 2: Ingredient composition of broiler finisher diets

	Dietary treatments				
Ingredients	T1	T2	T3	T4	T5
Maize	50.00	50.00	50.00	50.00	50.00
Soybeans	32.70	30.70	29.70	27.70	25.70
COLM	0.00	3.00	6.00	9.00	12.00
Wheat offal	12.00	11.00	9.00	8.00	7.00
Fish meal	2.00	2.00	2.00	2.00	2.00
Bone meal	2.50	2.50	2.50	2.50	2.50
Premix*	0.25	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25	0.25
Methionine	0.20	0.20	0.20	0.20	0.20
Lysine	0.10	0.10	0.10	0.10	0.10
Total	100	100	100	100	100
Calculated analysis					
Crude protein	20.01	20.01	20.01	20.01	20.01
Crude fibre	4.00	4.30	4.70	5.00	5.30
Calcium	1.00	1.10	1.20	1.30	1.40
Phosphorus	0.50	0.50	0.60	0.60	0.70
Methionine	0.50	0.50	0.50	0.40	0.40
Lysine	1.10	1.00	1.00	1.00	1.00
ME(Kcal/kg)	3072.70	3049.50	3040.60	3017.40	2994.00

*Vitamin- Mineral premix (Bio-mix) provided per kg include the following: Vitamin A 500 IU; Vitamin D_3, 888,000 iu; Vitamin E, 12,200mg; Vitamin K_3 15,000mg; Vitamin B_1, 100mg; B_2, 200mg; B_6, 1500mg; Niacin, 1200mg; Pathothenic acid, 2000mg; Biotic, 100mg; Vitamin B_{12}, 3000mg; Folic acid, 1500mg; Chlorine chloride, 60,000mg; Manganese, 10,000mg; Iron, 1500mg; Zinc, 800mg; Copper, 400mg; Iodine, 80mg; Cobalt, 40mg; Selenium, 8000mg.

Data Collection

Feed intake was determined as the differences between feed offered and feed left over. Birds were weighed weekly to determine weekly weight gain. Feed intake and weight recorded were used to calculate feed conversion ratio (FCR).

Carcass and Organs Weight determination

At the end of the study, two birds per replicate were selected randomly and starved for about 12 hours to empty the crops. They were then slaughtered, scalded, plucked and eviscerated. The carcass and internal organs were removed, weighed and expressed as a percentage of live weight.

Haematological and Biochemical Indices

On the last day of the experiment, blood samples were collected from four birds per treatment for determination of haematology and serum biochemical parameters. 5mls of blood samples were collected from the wing vein of each experimental bird using a disposable needle and syringe into specimen test tubes containing Ethylene Diamine Tetra Acetic Acid (EDTA) as anticoagulant for haematological parameters (Packed Cell Volume, Red Blood Cells, Heamoglobin concentration, White Blood Cells. The erythrocytic component; Mean Corpuscular Volume (MCV), Mean Corpuscular Heamoglobin (MCH) and Mean Corpuscular Heamoglobin Concentration (MCHC) were determined using the formula described by (Jain, 1993); while another 5ml were placed in test tubes without anticoagulant to determine the serological parameters (total protein, albumin, urea, creatinine, cholesterol, globulin and glucose).

Chemical analysis

Proximate composition of experimental diets, *Cassia obtusifolia* leaf meal and anti-nutritive factors were analyzed using the methods described by AOAC (2000).

Statistical analysis

All data obtained during the experiment were subjected to Analysis of Variance (ANOVA) described by Steel and Torrie (1980). Means were separated using Duncan Multiple Range Test (Duncan, 1955).

RESULTS AND DISCUSSION

Proximate Composition of *Cassia obtusifolia* Leaf Meal (COLM)

The result of the proximate composition of *Cassia obtusifolia leaf meal* is presented in Table 3.The result shows that it contains 93.51% dry matter, 25.44% crude protein, 19.14%,crude fibre and 38.19% nitrogen free extract. The leaf meal also contains saponin (6.26%) phytate (2.97%), tannins (4.52%) and oxalates (2.37%). The crude protein value was similar to 25.37% reported by Abu et *al.* (2015) but higher than 21.10% reported by Adjoudji *et a*l. (2005). The value however was lower than 27.40% reported by Ayssiwede *et al.* (2012). Crude fibre value was similar to the 19.25% reported by Odura *et al.* (2008).The metabolizable energy was higher than 2050 Kcal/kg reported by Ayssiwede *et al.* (2012). Tannin content recorded was similar to 4.06% reported Nuhu *et al.* (2010). However, the phytate value obtained was lower than 13.52% recorded by Nuhu *et al.* (2010). Studies have attributed variations in nutrient composition and anti-nutritive factors of leaf meals to the age of leaves at harvesting, climatic conditions, edaphic factors as well as methods of processing and laboratory analysis (Taiwo et al., 2005).

Table 3: Proximate Composition/Antinutritional Factors of *Cassia obtusifolia* Leaf Meal

Nutrients	Percentage Composition
Dry mater	93.51
Crude Protein	25.44
Crude fibre	19.14
Total ash	12.17
Ether Extract	4.06
Nitrogen free extract	38.19
Metabolizable Energy	2629.14
Anti-nutritional factors	
Tannin	4.52
Saponin	6.26
Oxalate	2.37
Phytate	2.97

Performance of broiler chickens fed *Cassia obtusifolia* Leaf Meal

The growth performance of broiler chickens fed graded levels of *Cassia obtusifolia* leaf meal is presented in Table 3. The result showed significant differences (P<0.05) in all the parameters measured for growth performance except total feed intake and average daily feed intake. Final weight however decreased (P<0.05) progressively with increasing levels of COLM in the diets. This trend could be attributed to imbalance in nutrient composition and improper metabolism associated with the leaf meal when fed beyond 9% inclusion as reported by (Esonu et al., 2005 and Abu et al., 2015).Total feed intake was not significantly (P<0.05) influenced by inclusion levels of COLM although it progressively increased as the levels of inclusion of COLM increased. This result agreed with early study by Ossebi *et al.* (2010) who reported the non-significant (p>0.05) effect on feed intake when broiler chickens were fed with COLM. Feed conversion ratio differ significantly (p>0.01) among the treatment groups. FRC was superior in birds on T1 (2.26) and T2 (2.3), while treatments 3, 4 and 5 are similar. The relatively higher values for feed conversion ratio of birds in treatments 3, 4 and 5 suggests poor utilization of the diets at an incremental level of COLM. The result is in conformity with the findings of Onu, (2012) who observed significant (p<0.05) differences in FCR when broiler chickens were fed pumpkin leaf meal.

Table 4: Effects of *Cassia obtusifolia* Meals on the Growth Performance of Broiler

	Dietary Treatment(s)					
Parameter	T1	T2	T3	T4	T5	SEM
Initial weight (g)	156.60	144.50	153.30	151.47	149.85	4.47^{ns}
Final weight (g)	2136.00^{a}	2100.41^{ab}	2015.44^{ab}	1955.30^{b}	1719.62^{c}	50.12*
Total Weight Gain (g)	1979.40^{a}	1955.84^{ab}	1892.14^{ab}	1803.83^{b}	1650.77^{c}	49.03*
Average daily weight gain (g)	40.39^{a}	39.91^{ab}	38.00^{ab}	36.81^{b}	31.99^{c}	1.00*
Total feed intake (g)	4470.55	4496.87	4491.85	4492.66	4609.87	10.22^{ns}
Average feed intake (g)	91.23	91.77	91.67	91.68	94.07	2.00^{ns}
Feed conversion ratio	2.26^{a}	2.30^{a}	2.41^{bc}	2.50^{c}	3.13^{c}	0.18*

Means on the same row with different subscripts are significantly different (p>0.05)

Effects of feeding *Cassia obtusifolia* leaf meal on Carcass Yield and Internal Organs Weight of Broiler chicken

The values of live weight, plucked weight, eviscerated weight, carcass weight and dressing percentage were not significantly (p>0.05) different across the treatment groups. The result agreed with the findings of Ayssiwede *et al.* (2012), who observed no significant difference in carcass characteristics when they fed *Cassia obtusifolia* leaf meal to broiler chickens.

The dressing percentage ranged from 68.20 - 70.60% and is within the range of 67.32-71.59% reported by Onunkwo and George (2015).

The result of the internal organs evaluation showed that only pancreas, large and small intestinal weight showed variation across the treatments. All other parameters are similar. The result is contrary to the reports of Ayssiwede *et al.* (2012) and that of Zanu *et al.* (2012) who in their separate studies showed no significant (p>0.05) difference in internal organs of birds fed diet containing different levels of *Cassia obtusifolia* leaf and moringa leaf meals to broiler finishers respectively. However, values for heart and lungs were similar to the range of 0.41-0.57 and 0.58 - 0.61 respectively reported by Onunkwo and George (2015). It is evident therefore that the inclusion of COLM in the diet of broiler chickens did not illicit any toxic response by the bird as liver and kidney which are the major organs of detoxification did not undergo any hypertrophy (Carew et al., 2003).

Table 5: Carcass Analysis and Internal Organ Weight

	Dietary Treatments					
Parameters	T_1	T_2	T_3	T_4	T_5	SEM
Live weight	2220.00	2195.00	1985.00	2155.00	2280.00	74.10^{ns}
Plucked weight	2027.50	2027.50	2062.50	1957.50	1817.50	65.90^{ns}
Eviscerated weight	1707.50	1647.50	1685.00	1640.00	1487.50	53.71^{ns}
Carcass weight	1565.00	1540.00	1555.00	1472.50	1362.50	53.28^{ns}
Dressing percentage	70.60	70.17	68.47	68.35	68.21	0.90^{ns}
Internal Organs (% live weight)						
Head	3.02	3.07	2.74	2.90	3.03	0.12^{ns}
Leg	4.27	4.68	4.28	4.19	4.54	0.28^{ns}
Liver	2.37	2.27	2.29	2.32	2.40	0.12^{ns}
Lungs	0.78	0.56	0.65	0.58	0.75	0.18^{ns}
Kidney	0.25	0.27	0.23	0.23	0.25	0.02^{ns}
Gizzard	3.70	3.76	2.85	3.82	3.29	0.29^{ns}
Heart	0.55	0.45	0.44	0.46	0.65	0.06^{ns}
Pancreas	0.22^{c}	0.45^{ab}	0.44^{ab}	0.35^{b}	0.50^{a}	0.03*
Ceacal weight	0.67	0.68	0.59	0.46	0.50	0.09^{ns}
Small intestine weight	4.40^{c}	4.43^{c}	4.74^{bc}	5.61^{ab}	5.99^{a}	0.36*
Large intestine weight	0.45^{a}	0.34^{ab}	0.22^{b}	0.46^{a}	0.38^{a}	0.04*
Abdominal Fat	1.25	1.36	1.09	0.84	0.69	0.24^{ns}

Means on the same row with different subscripts are significantly different ($p<0.05$)

Haematology and Biochemical Indices of Boilers Fed Graded Levels of COLM

Haematology and biochemical indices of broiler chickens fed with COLM are shown in Table 6. The result showed no significant difference ($p<0.05$) across the treatment groups for all the parameters measured. PCV and RBC values ranged from 32.36-34.03 and 2.37- 2.46 respectively. Hb varied from 9.80 in T1 to 10.16 in T4. Total protein, albumin and cholesterol ranged from 30.93-34.56g/l, 13.80 – 15.23g/l and 41.80 – 50.00mg/dl respectively. The value of parked cell volume falls within the normal range of 25-40% reported by Anon (1980) and it also agreed with the value of 29.75-32.87 reported by Chinrasri *et al.* (2007). Haemoglobin concentration and red blood cells are within the normal range (Allelo and Mays (1998); Fumilayo and Ayodele (2016)). Lower count of red blood cells may indicate anaemia as a result of blood loss, bone marrow failure, and malnutrition such as iron deficiency, over-hydration, or mechanical damage to red blood cells, while high numbers of red blood cells count may indicate congenital heart disease, lung diseases, dehydration, and kidney disease (Fajohunbo, 2010). The value for MCV is within the normal range value of 113-144fl as reported by Talebi *et al.* (2005), indicating that the experimental diets met the birds nutritional requirements. A low MCV may indicate iron deficiency, chronic disease, pregnancy, a haemoglobin disorder such as thalassaemia, anaemia due to blood cell destruction or bone marrow disorders. A high MCV may indicate anaemia due to nutritional deficiencies, bone marrow abnormalities, liver disease, chronic lung disease, or therapy with certain medications (Jaime and Howlett, 2008). Serum biochemical analysis is used to determine the level of heart attack, liver damage and to evaluate the protein quality and amino acid utilization in animals (Harper *et al*., 1999). All the values of serum biochemistry are within the normal range. This implied that COLM can be used in broiler diet to provide adequate nutrition. Similarly, non-significant differences in serum albumin, creatinine, urea and total protein showed that there was normal protein metabolism. This also implies that the diets had better nutritional quality and good amino acid balance to meet the nutrient requirement of the birds.

Table 6: Haematological and Biochemical indices of Broiler Chickens Fed *Cassia obtusifolia* Leaf Meal

	Dietary treatments					
Parameters	T1	T2	T3	T4	T5	SEM
Parked Cell Volume (%)	32.36	33.06	33.50	34.03	33.20	0.81^{ns}
Red Blood Cells ($x10^3$/µl)	2.45	2.44	2.43	2.46	2.37	0.10^{ns}
Haemoglobin($x10^3$/µl)	9.80	9.86	10.06	10.16	10.10	0.27^{ns}
White Blood Cell ($x10^3$/ µl)	252.04	246.10	246.33	233.26	249.66	6.40^{ns}
MCH (pg)	40.06	40.46	41.50	41.36	42.73	0.78^{ns}
MCV (fl)	132.46	135.53	138.23	138.40	140.36	2.83^{ns}
MCHC (mmol/L)	30.23	29.83	30.03	29.90	30.46	0.11^{ns}
Platelets	9.33	7.33	9.00	8.66	5.00	1.45^{ns}
Biochemical indices						
Total Protein (g/L)	33.80	34.56	31.66	30.93	34.13	1.73^{ns}
Albumin (g/L)	13.80	15.23	14.20	13.56	14.63	0.096^{ns}
Cholesterol (mg/dl)	49.00	50.50	41.80	42.03	49.33	2.6^{ns}
Globulin (g/L)	20.00	19.33	17.46	17.36	19.50	1.17^{ns}
Creatinine(mmol/L)	76.63	73.66	88.40	88.40	76.63	6.56^{ns}
Glucose (mmol/L)	8.33	8.50	8.36	10.13	9.23	0.68^{ns}
Urea (mg/dl)	5.66	5.46	6.26	7.43	6.70	0.67^{ns}

MCH= Mean corpuscular haemoglobin, MCV= Mean corpuscular volume, MCHC= Mean haemoglobin concentration

CONCLUSION

It could be concluded from the results obtained that COLM can be included up to 9% in broiler chickens' diet without adverse effect on the growth performance, blood profile, carcass and internal organs characteristics.

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