



GROWTH AND BLOOD RESPONSE OF BROILER FINISHER CHICKENS TO DRIED *Chrysophyllum albidum* PULP MEAL-BASED DIET

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ABSTRACT

*This study was conducted to evaluate the response of broiler finisher chicken to dried *Chrysophyllum albidum* pulp meal-based diets using performance and hematological indices as criteria. A total of one hundred and fifty birds were raised at starter phase. Out of which one hundred and twenty were selected for finisher phase at 4 weeks of age. These were allotted into four treatments of three replicates and ten birds per replicate. Dried *C. albidum* pulp meal was incorporated into broiler ration at the rate of 0, 4, 6.5 and 9% inclusion levels in diets or treatments 1(T1), 2(T2), 3 (3) and 4 (T4) respectively. The experiment was arranged in a complete randomized design and data collected were subjected to one-way analysis of variance using the SAS version 9.1 and the means were compared using Duncan's Multiple Range Test. The results of performance were significantly different in all parameters and across the treatments. Experimental birds on T4 (9% inclusion) elicited highest feed intake and FCR. Birds on T1 recorded the highest daily weight gain while those on T2 had the least FCR which is not significantly ($p>0.05$) different from those on T1. Haematological parameters such as PCV, Hb, RBC, MON and BAS were significantly ($p<0.05$) different across the treatments while cholesterol, TP, globulin, triglyceride and ALP were significantly ($p<0.05$) different in serum biochemistry. The results revealed that birds on T2 were able to utilize the diet more effectively than any other treatment. Also, values for haematological parameters and serum biochemistry fall within the range for a normal physiological status of the birds. It was therefore concluded that dried *C. albidum* pulp has a potential to be feedstuff for broiler chicken.*

Key words: *Chrysophyllum albidum*, Broiler chicken, Growth performance, Haematology, Serum biochemistry.

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INTRODUCTION

Chrysophyllum albidum tree is a tree of economic importance commonly found throughout tropical Africa. It is a seasonal fruit bearing tree that produces fruits between November and early April. The fruit is known as "Agbalumo" in Yoruba language of south western Nigeria and "Udara" in Igbo language of the Eastern part of Nigeria. The fruit is pale yellow with pink-coloured endocarp. It is golden yellow, fleshy and juicy when fully ripe.

From various researches on nutritional constituents of *C. albidum* pulp it was evident that the macro nutrients are low;

Crude Protein of 0.59% - 8.2% depending on the stage of ripening (Ige and Gbadamosi, 2007; Ureigho and Ekeke, 2010; Oloyede and Oloyede, 2014), Crude Fibre of 0.4% - 4% and total Carbohydrates of 11% - 25.68% (Ureigho and Ekeke, 2010; Oloyede and Oloyede, 2014). However, the fruits are rich in micro nutrients such as potassium, calcium, phosphorus, ascorbic acid and carotene (Ureigho and Ekeke, 2010; Adepoju and Adeniyi, 2012) and low content of iron and anti-nutritional factors (Adepoju and Adeniyi 2012). The fruit has been reported to be a natural source of antioxidants (Oloyede and Oloyede, 2014) and can promote health

by acting against oxidative stress-related diseases such as infections (Buritis and Bucar, 2002). Micro nutrients are known to aid efficient utilization of feed by animals and with the nutrient factors of *C. albidum*, it may be a suitable feedstuff for broilers which its maximum production depends on proper feed utilization and stress-free growth. Since blood examination plays a vital role in the physiological, nutritional and pathological status of an animal at a particular point in time (Folorunso *et al.*, 2012), this study therefore aimed at assessing the response of broiler finishers to dried *C. albidum* pulp-based diets using performance and haematological parameters as indices.

MATERIALS AND METHODS

Experimental site: The feeding trial was carried out at Teaching and Research Farm of Animal Science Department, Osun State University, Ejigbo Campus, Nigeria; while the Proximate Composition analysis were carried out at the Laboratory of the Department.

Test ingredients and feed preparation: Ripe *C. albidum* fruits were collected at Igbon village via Ejigbo, Osun State. The fruits were thoroughly washed and the seeds were extracted. The fresh fleshy pulps were weighed and then oven dried at 50⁰C till the weights were constant. The dried *C. albidum* pulp was then milled into 2mm size particles. A sample of the dried *C. albidum* pulp meal was then analyzed for proximate compositions according to AOAC (2000), while varying or graded quantities were incorporated into broilers finisher diet. Table 1 and 2 show the gross composition of experimental diet for starters and finishers respectively.

Experimental birds and procedure: A total of one hundred and fifty-day-old chicks were purchased from a reputable hatchery and

raised in a deep litter pen for four (4) weeks that constituted the starter phase. At the end of the 4th week, a total of one hundred and twenty (120) birds were selected and allotted on weight equalization basis into four (4) treatments of three (3) replicates at ten (10) birds per replicate. These birds were then fed with dried *C. albidum* pulp-based diet throughout the finisher phase of four (4) weeks feeding trial with the inclusion level of 4.0, 6.5 and 9.0% respectively in diets for birds on treatments 2 (T₂), 3 (T₃), and 4 (T₄) respectively. Diet or Treatment 1 without the dried *C. albidum* pulp (0%) served as the control. Throughout the period of the study, the experimental birds were fed *ad libitum*. Water was also provided *ad libitum*. The weights of the experimental birds were taken every week to monitor the weight gained. Proper hygiene was maintained throughout. Also, the required vaccination and medications were administered at the appropriate time.

The broiler starter diet fed during the first four weeks was made up of maize (51.2%), groundnut cake (12%), soybean meal (12%), wheat offal (8.95%), fish meal (11%), bone meal (3%), oyster shell (1.2%), salt (0.05%), premix (0.5%), lysine (0.05%) and methionine (0.05%). The diet contained 21.65% protein and 2887Kcal/kg Metabolizable Energy. At the end of the 8th week of the experiment, six (6) birds per treatment (2 birds per replicate) with the closest weight to the average weight of the replicate were randomly selected for blood collection. Blood was withdrawn through jugular vein using a syringe. 5ml of blood samples were collected from each bird and was carefully discharged into sets of sterile bottles; purple-top bottles with anti-coagulant for haematology and red-top bottles with coagulant for serum biochemical analysis. The blood samples were taken to the laboratory to analyze for haematological parameters like Packed Cell Volume (PCV),

Haemoglobin, Red Blood Cells (RBC), White Blood Cells (WBC), Platelets, Lymphocytes, Heterophils, Monocytes, Eosinophils, and Basophils (Coles, 1986)); serum biochemical parameters like Aspartate aminotransferase (AST), Alanine aminotransferase (ALT) and Cholesterol (Davice and Lewis, 1991), Total Protein, Albumin, Globulin, Triglyceride, Alkaline phosphate and High-Density Lipoprotein

according to the procedure of Holder and Rej (1983) and Mitruka and Rawnsley (1981).

Statistical analysis: The experiment was arranged in a Completely Randomized Design (CRD) and all data obtained were subjected to one-way Analysis of Variance (ANOVA) using the Statistical Analysis System (SAS, 2010). Means were compared or separated using Duncan Multiple Range Test (Steel and Torrie, 1980).

Table 2: Gross composition of experimental broiler finisher mash with varying levels of dried *C. albidum* pulp

Diets or Treatments Levels of <i>C. albidum</i>	T ₁ 0	T ₂ 4.0	T ₃ 6.5	T ₄ 9.0
<i>Ingredients:</i>				
Maize	55.15	53.15	50.90	49.90
Groundnut Cake	10.00	10.00	10.00	9.75
Soybean Meal	12.00	12.00	11.75	11.00
Wheat Offal	10.00	8.00	8.00	7.50
Fish Meal	8.00	8.00	8.00	8.00
Bone Meal	3.00	3.00	3.00	3.00
Oyster Shell	1.20	1.20	1.20	1.20
Salt	0.05	0.05	0.05	0.05
*Premix	0.50	0.50	0.50	0.50
Lysine	0.05	0.05	0.05	0.05
Methionine	0.05	0.05	0.05	0.05
<i>Chrysophyllum albidum</i>	-	4.00	6.50	9.00
Total	100	100	100	100
<i>Calculated Analysis:</i>				
Crude Protein (%)	20.03	19.92	19.65	19.22
Metabolizable Energy (KCal/Kg)	2870	2847	2766	2671
<i>Determined Analysis:</i>				
Crude Fibre	15.10	16.15	16.40	16.92

*Premix (added at 2.5kg/ton of feed) contained Vit. A, 8.5M IU; Vit. D₃, 150000 IU; Vit. E, 10,000mg; Vit. K₃, 1,500mg; Vit. B₁, 1,600mg; Vit. B₂, 4,000mg; Niacin, 20,000mg; Pantothenic acid, 5,000mg; Vit. B₆, 1,500mg; Vit. B₁₂, 10mg; Folic acid, 500; Biotin, 750mg; Choline chloride, 175,000mg; Cobalt, 200mg; Copper, 3000mg; Iodine, 1,000mg; Iron, 1,000mg; Mn, 40,000mg; Se, 200mg; Antioxidant, 1,250mg.

RESULTS

The result of the performance of the experimental birds is presented on Table 4. All the results were significantly ($p < 0.05$) different from each other. The result showed that birds on 0 % level of *C. albidum* had the highest final body weight (2280.30g). This

was significantly ($p < 0.05$) higher than what obtained in other treatments. It was followed by the weight of birds on T₃ (2094.67g), then T₂ (2029.0g) and T₄ (1878.33g).

Daily weight gained by the birds revealed that birds on T₁ gained more weight than other treatments (57.20g). This is

significantly ($p < 0.05$) higher than those on T₂ (48.40g) and other treatments. This was closely followed by those on T₃ (47.87g) and then T₄ (41.11g).

Results of daily feed intake indicated that birds on T₄ (163.38g) consumed significantly ($p < 0.05$) more than all other treatments. This was followed by birds on T₃ (157.32g) and T₁ (155.45g) with T₂ (152.71g) consumed least. The results obtained for Feed Conversion Ratio (FCR) was slightly different. The highest value was recorded for birds on T₄ (3.40) which is not significantly ($p > 0.05$) different from those on T₃ (3.29)

but significantly ($p < 0.05$) different from those on T₁ (2.72), and T₂ (2.21) that were not significantly different from each other.

Table 3: Proximate composition of *Chrysophyllum albidum*

Parameters	Percentage
Dry matter	85.70
Crude protein	6.62
Crude fibre	15.10
Ether extract	6.70
Ash	10.84

Table 4: Growth performance of experimental broiler finishers birds fed *C. albidum* based diet

Treatments	T ₁	T ₂	T ₃	T ₄	SEM
Levels of <i>C. albidum</i> (%)	0	4.0	6.5	9.0	
<i>Parameters:</i>					
Initial body weight (g)	610.35	610.00	610.00	609.78	0,05
Final body weight (g)	2280.30 ^a	2029.0 ^c	2094.67 ^b	1878.33 ^d	1.43
Daily weight gain (g)	57.20 ^a	48.40 ^b	47.87 ^c	41.11 ^d	0.08
Daily feed intake (g)	155.45 ^c	152.71 ^d	157.32 ^b	168.38 ^a	0.07
Feed Conversion Ratio	2.72 ^b	2.21 ^b	3.29 ^a	3.40 ^a	0.48

^{a-d}Means on the same row having different superscript are significantly ($p < 0.05$) different.

SEM = Standard error of mean.

The result of haematological parameters of finisher broilers fed dried *C. albidum* pulp-based diets is as presented on Table 5 below. The result revealed that Packed Cell Volume (PCV), Haemoglobin (Hb), Red Blood Cell (RBC), Monocytes (MON) and Basophils (BAS) were significantly ($p < 0.05$) different while other parameters; White Blood cells (WBC), Platelets, Lymphocytes, Heterophils and Eosinophils were not significantly ($P > 0.05$) different from each other.

Birds on T₃ had the highest value for PCV (28.50%). This was significantly ($p < 0.05$) different from other treatments which were not significant from each other. Results of Hb revealed that birds on T₃ had the highest value of 9.40g/dl which was not

significantly ($p < 0.05$) different from those on T₁ (8.50g/dl) but significantly ($p < 0.05$) higher than those on T₄ (8.00g/dl) and T₂ (7.90g/dl). Red blood cells counts of birds on T₃ were significantly ($p < 0.05$) higher than those on T₂ and T₄ but not significantly ($p < 0.05$) different from those on T₁.

Monocytes counts revealed that birds on T₄ had significantly ($p < 0.05$) higher value than that of T₃ but not significantly ($p < 0.05$) higher than those on T₁ and T₂. Basophils counts was absent in T₃ and T₄ while T₂ (0.50%) and T₁ (1.00%) had few. Parameters measured for Serum Biochemistry are presented on Table 6. It was revealed that AST, ALT, ALP and HDL were not significantly ($p > 0.05$) different across the treatments, while other parameters

(Cholesterol, Total Protein, Albumin, Globulin, Triglyceride,) showed significant differences.

Birds on T₃ recorded the highest Cholesterol level (186.94mg/dl), while those on T₄ recorded the least (105.68 mg/dl). Total Protein was higher in birds on diet T₁

(2.74g/dl) and was least in birds on T₃ (2.27g/dl). Globulin and Alkaline phosphate followed the same trend with birds on T₄ having the highest level (1.07g/dl and 504.77i.µ/l respectively), while birds on T₂ recorded the least (0.54 g/dl and 426.72 i.µ/l).

Table 5: Haematology of broiler finisher chickens fed dried *C. albidum* pulp meal-based diets

Treatments	T ₁	T ₂	T ₃	T ₄	SEM
Levels of <i>C. albidum</i> (%)	0	4.0	6.5	9.0	
<i>Parameters:</i>					
Packed Cell Volume (%)	25.00 ^b	24.50 ^b	28.50 ^a	24.50 ^b	0.80
Haemoglobin (g/dl)	8.50 ^{ab}	7.90 ^b	9.40 ^a	8.00 ^b	0.36
Red Blood Cell (x10 ⁶ /mm ³)	2.71 ^{ab}	2.20 ^b	3.30 ^a	2.10 ^b	0.24
White Blood cells (x10 ⁴ µl)	1.75	1.53	1.58	1.47	0.88
Platelet (x10 ⁶ µl-1)	1.69	1.82	1.86	1.78	0.22
Lymphocytes (%)	66.50	62.50	67.00	62.50	1.68
Heterophils (%)	26.50	30.50	27.50	31.00	1.77
Basophils (%)	2.50 ^{ab}	3.50 ^a	1.50 ^b	4.00 ^a	0.56
Eosinophils (%)	3.50	4.00	4.00	2.50	0.61
Monocytes (%)	1.00 ^a	0.50 ^b	0.00 ^c	0.00 ^c	0.41

^{a-d}Means on the same row having different superscript are significantly (p < 0.05) different.

SEM = Standard error of mean.

Table 6: Serum biochemistry of experimental birds fed *C. albidum* based diet

Treatments	T ₁	T ₂	T ₃	T ₄	SEM
Levels of <i>C. albidum</i> (%)	0	4.0	6.5	9.0	
<i>Parameters:</i>					
AST (iµ/l)	178.79	155.23	177.22	148.69	15.98
ALT (iµ/l)	16.65	20.91	21.49	22.93	2.18
Cholesterol (mg/dl)	122.73 ^b	164.77 ^a	186.94 ^a	105.68 ^c	10.55
TP (g/dl)	2.74 ^a	2.55 ^{ab}	2.27 ^b	2.70 ^a	0.10
Albumin (g/dl)	1.77	2.01	1.71	1.63	1.16
Globulin (g/dl)	0.96 ^a	0.54 ^b	0.56 ^b	1.07 ^a	0.10
Triglyceride (mg/dl)	59.82 ^c	155.77 ^a	67.59 ^c	92.02 ^b	6.99
ALP (iµ/l)	462.41 ^a	426.72 ^{ab}	498.47 ^b	504.77 ^a	12.56
HDL (mg/dl)	33.82	31.99	30.67	33.00	1.26

^{a-d}Means on the same row with different superscript are significantly (p < 0.05) different.

AST = Aspartate aminotransferase; ALT = Alanine aminotransferase; TP = Total protein; ALP = Alkaline phosphate; HDL = High density lipoprotein; SEM = Standard error of mean.

DISCUSSION

Results of performance of broiler finisher fed *C. albidum* based diet shows that increasing level of *C. albidum* resulted in a

decreased level of body weight gained despite the fact that feed intake increased. This is an indication that *C. albidum* feed were not well utilized by the broilers.

However, the FCR revealed that birds on T₂ were able to utilize the dried *C. albidum pulp*-based diet more than any other treatment, although, it was not significantly different from those on the control treatment (T₁). Nevertheless, the lower daily weight gained by birds on dried *C. albidum pulp*-based diet may be as a result of anti-nutritional factors such as tannins and saponin that are present in *C. albidum*, which are known to impair digestion.

Birds on T₄ consumed more than other treatments and yet had highest FCR and lowest daily weight gain. Studies had shown that increased fibre levels reduces voluntary intake particularly for non-ruminants which have limited ability to utilize fibrous diets (Mnisi and Mlambo, 2017).

The results of the haematological parameters of the experimental birds revealed that all values for RBC, Haemoglobin, Basophils, Lymphocytes, Platelets and Monocytes fall within the range for a normal physiological and nutritional stable chicken as reported by Mitruka and Rawnsley (1981). Although, PCV falls within the range of 24.9 – 40.7% as reported by the same authors – Mitruka and Rawnsley (1981), but it was a little above the minimum (24.50% – 28.50%) across the treatments. WBC values were also just above the minimum and in accordance with reference value reported by Aeangwarich *et al.*, (2004).

The serum biochemistry shows that total protein was not significantly different across the treatments. This may be because blood protein is not influenced by partial changes of protein in the diet (Bovera *et al.*, 2007), especially with isonitrogenous diet such as the experimental diet used. The Albumin concentration was similar. From the results, birds on T₂ and T₃ had a significantly higher level of cholesterol than T₁ and T₄, but the values obtained for HDL were inverse to those of cholesterol, although not

significantly ($P > 0.05$) different across the treatments.

Determination of haematology and serum biochemical parameters is essential and effective to evaluate the effectiveness of diets in optimizing animal performance without compromising their health as changes in haematological levels usually a signal to onset of loss of weight, feathers, weak movement etc. (Mnisi and Mlambo, 2017). However, there are some factors (such as age, environmental, method of collection, etc.) that can cause variation in data obtained from an assay. Nevertheless, results falling within normal range is an indication that diet has no negative effect on physiological status of the birds, and thus, such feed can be a potential feed stuff for livestock such as broiler chicken.

CONCLUSION

- The inclusion of *Chrysophyllum albidum* in finisher broiler chicken diet had no adverse effect on their haematological and serum biochemical parameters, though it did not support the growth performance optimally.

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