

Effects of Dietary Siam Weed (*Chromolaena odorata*) Leaf Meal on the Growth Performance, Blood Profile and Meat Quality Attributes of Broiler Chickens

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Target Audience: Commercial broiler farmers, Poultry Researchers and poultry Farmers

Abstract

*A six-week feeding trial was conducted to assess the effects of dietary inclusion of Siam weed (*Chromolaena odorata*) leaf meal (COLM) on growth performance, hematological, serum biochemical indices and meat quality attributes of broiler chickens. Two hundred (200) day-old Arbor Acre broiler chicks were randomly assigned to five dietary treatments with five replicates of eight birds in a completely randomized design. The diets with COLM at 0g, 5g, 10g, 15g, and 20g per kg of feed were designated as diet 1-5. Results showed that dietary COLM had significant ($P < 0.05$) influence on the feed intake, average daily feed intake (ADFI) and feed conversion ratio (FCR). Birds fed 15g COLM recorded the highest total feed intake (4426.20g) and average daily feed intake (85.12g), while birds on 5g COLM diet had the lowest feed conversion ratio (1.83). Hematological parameters showed that birds fed diets containing 5g COLM had the highest value for the PCV, RBC, LYM and the least value for Heterophyls. The triglycerides, Aspartate aminotransferase (AST), Alanine aminotransferase (ALT) were significantly different in the parameters assessed for serum biochemistry. Triglycerides had the highest value of (124.15mg/dL) for T2 and the least value of (88.52mg/dL) for T5. There were significant differences ($p < 0.05$) in the thermal shortening and the water holding capacity for meat quality attributes. Treatment five (20g) had the highest value for the thermal shortening (45.07) and the least value for the water holding capacity (62.67). In conclusion, dietary inclusion of COLM up to 15g enhanced growth performance without adverse effects.*

Description of Problem

The demand for animal products, particularly meat and eggs, continues to rise in developing countries. However, many populations still consume less animal protein than the recommended

daily intake. According to FAO (1), Nigerians consume less than the recommended 35 g of animal protein per day. One way to bridge this gap is through the production of fast-growing livestock such as broiler chickens, which have a short generation interval and provide a

viable source of affordable protein (2). Despite their efficiency, poultry products remain expensive due to the high cost of conventional feed ingredients, necessitating the search for alternative, cost-effective feed sources (3).

The use of plant-based feed ingredients is gaining attention among poultry researchers as a means to reduce feeding costs while maintaining nutritional quality and bird health (4). Alternative feed sources such as leaf and seed meals of tropical plants are being explored to replace expensive protein and energy feedstuffs. *C.odorata* has been identified as a potential unconventional feedstuff due to its relatively high crude protein, dry matter, vitamin, and mineral content (5). Furthermore, sun-drying its leaves significantly reduces its characteristic offensive odor, making it a more palatable feed ingredient (6).

Siam weed (*Chromolaena odorata*), formerly known as *Eupatorium odoratum*, is a rapidly growing perennial shrub belonging to the family Asteraceae. Though often regarded as an invasive weed due to its aggressive spread and ability to smother crops (7), *C.odorata* possesses notable medicinal and nutritional properties. Traditionally, its leaves have been used as an antimicrobial agent against *Bacillus cereus*, an antifungal agent against *Aspergillus niger*, and a mosquito repellent (8). Additionally, the juice from fresh leaves can help reduce bleeding when applied to wounds, and it has been utilized for various medicinal purposes, including anti-diarrheal, antihypertensive, anti-

inflammatory, and antipyretic treatments (9).

Evaluating the effects of *C.odorata* on broiler chickens is essential to determine its impact on growth performance, meat quality attributes, and blood profile (10). Hematological and biochemical analyses provide insights into the physiological and health status of poultry. These assessments help determine the safety and efficiency of incorporating unconventional feedstuffs into poultry diets and reduces the cost greatly (11). Several studies indicate that diet composition significantly influences hematological parameters, which are vital in diagnosing metabolic and pathological disorders (12). Although research on the nutritional implications of *C.odorata* in poultry diets remains limited, preliminary findings suggest it could serve as a viable feed alternative. This study aims to investigate the effects of Siam weed on the growth performance, meat quality attributes, and blood profile of broiler chickens.

Materials and Methods

Experimental site: The experiment was carried out at the teaching and research farm of the Federal College of animal Health and Production Technology, Moor Plantation Ibadan. The experiment lasted for six (6) weeks. The area lies within the rain forest ecological zone and fall within longitude and latitude 7°27'N and 3° 25'E respectively; altitude 200-300m above the sea level with an average rainfall of about 1250mm. The temperature and Relative Humidity

ranges from 30-35° and 76-84% respectively.

Experimental Animals and their Management:

Before their arrival, the brooding house was thoroughly washed, disinfected, and allowed to dry. It was then pre-heated for 6-12 hours to reach the required temperature of 32°C for day-old chicks. Fresh feed and water were provided ad libitum, while heat and light were supplied. All prophylactic measures such as vaccination and medication were strictly adhered to. Various materials were used in the study, including feeders for feeding, drinkers for serving water, and a sensitive weighing scale for measuring both drugs and birds. Wood shavings served as bedding material. Other essential materials included sample bottles, buckets, a cutlass, a shovel, a slaughtering knife, brooms, packers, feed materials, and water.

Experimental Design

A Total of two hundred birds (200) were divided into five (5) treatment groups of forty (40) birds each and replicated five (5) times with at least eight (8) birds per replicate in a completely randomized design

Experimental diets

Five (5) experimental diets were formulated using commercial feed. The control (T1) birds were administered, medication and the normal vaccination schedule for broiler chickens were strictly adhered to with no test ingredients in their diets. Treatment two (T2) contained 5g of *Chromolaena odorata* leaf meal per one

kg of feed with no medication or vaccination. Treatment three (T3) contained 10g of *Chromolaena odorata* leaf meal per one kg of feed with no medication or vaccination. Treatment four (T4) contained 15g of *Chromolaena odorata* leaf meal with no medication or vaccination. Treatment five (T5) contained 20g *Chromolaena odorata* leaf meal per one kg of feed with no medication or vaccination.

Collection and Preparation of test Ingredients

Siam leaf was collected from NCRI (National Cereal Research Institute Ibadan). The leaves were air-dried at low temperature and it was grinded with a hammer meal before it was packed into a container for use

Data Collection

Growth performance Characteristics

Feed intake was determined by obtaining the difference between feed offered and left over. Feed consumed per replicate in a treatment (g/bird) was recorded daily.

Feed intake= Feed offered- leftover

Body weight (BW) (g/bird). The initial weight was taken on arrival of the birds and body weight was measured subsequently using a sensitive scale on weekly basis throughout the experiment.

Weight gain= Final weight –Initial weight

Average daily weight was calculated as well

ADWG= total weight gained/number of days of the experiment

Feed conversion was calculated as feed intake divided by body weight gain

FCR= feed intake /weight gain

Blood

5ml of blood samples were collected from the jugular vein of one bird per replicate in each treatment making a total of four birds per treatment. 2.5 ml of the blood collected was put into a labelled sample bottle containing Ethylene Diamine Tetra Acetate (EDTA) and used for hematological analysis while the other 2.5 ml was put into plain sample bottles for Serum biochemical indices. The blood was allowed to clot at room temperature and serum separated by centrifuging within three hours of collection. The packed cell volume (PCV), haemoglobin (Hb), Erythrocyte count (RBC) and leukocyte count (WBC) were some of the parameters determined for the haematological analysis. Serum total protein, albumin, Serum glucose, Serum urea, Aspartate transaminase (AST) and Alkaline phosphate (ALP) activities were determined by respective standard procedures as outlined by (13) for the Serum biochemical indices. Globulin concentration was obtained by subtracting Albumin from Total Protein. Serum Cholesterol was measured using appropriate laboratory kits (14).

Statistical Analysis

All data collected were subjected to one-way analysis of variance using (30) and significant means were separated using Duncan's multiple range test of the same statistical package.

Results

Effects of dietary Siam Weed Leaf Meal (*Chromolaena odorata*) on the Growth Performance of Broiler chickens

Table 1 below shows the results for the growth performance of broiler chickens fed diets supplemented with Siam weed leaf (COLM). The feed intake, average daily feed intake and the feed conversion ratio were significantly different ($p < 0.05$). The highest value of the feed intake was recorded for T4 with a value of (4426.20g) and they were fed Siam weed leaf at 15g/kg and T5 (20g/kg feed) had the lowest value (3991.60g). For average daily feed intake, T4 has the highest value (85.12g/b/d). Treatment four (T4) have the highest value (2.27) for feed conversion ratio(FCR) and T2 has the lowest value (1.83), the lower the value, the better the feed conversion meaning they will take less feed to gain more weight.

Table 1: Effects of dietary Siam Weed Leaf Meal (*Chromolaena odorata*) on the Growth Performance of Broiler chickens

Parameters	T ₁	T ₂	T ₃	T ₄	T ₅	SEM	P value
Initial Weight (g/b)	39.54	39.54	39.54	39.54	39.55	0.00	0.98
Final Weight (g/b)	1722.50	1896.50	1850.50	1650.50	1680.50	36.62	0.29
Weight Gain (g/b)	1682.90	1856.90	1810.90	1610.90	1640.90	36.62	0.29
ADWG(g/b/d)	40.07	44.21	43.12	38.36	39.07	0.89	0.29
Feed Intake (g/b)	4060.80 ^{ab}	4164.60 ^{ab}	4208.70 ^{ab}	4426.20 ^a	3991.60 ^b	54.38	0.01
ADFI (g/b/d)	78.09 ^{ab}	80.09 ^{ab}	80.94 ^{ab}	85.12 ^a	76.76 ^b	1.05	0.02
FCR	1.95 ^{ab}	1.83 ^b	1.90 ^{ab}	2.27 ^a	2.02 ^{ab}	0.06	0.01

^{ab} means along the row with different superscripts are significantly different (P<0.05). Wt.- Weight, WG- weight gain, ADWG- Average daily weight gain, FI- feed intake, ADFI, Average daily feed intake and FCR- Feed conversion ratio. T₁..Treatment 1 (control), T₂..5g COLM, T₃...10g COLM, T₄..15g COLM and T₅... 20g COLM. COLM..*Chromolaena odorata* leaf meal

Effects of dietary Siam weed leaf meal (COLM) on the haematological parameters of broiler chickens.

Effects of the inclusion of graded levels of Siam weed leaf meal on the haematological parameters of broiler chickens is presented in Table 2. The packed cell volume (PCV), Red blood cells (RBC), lymphocytes and heterophyls showed significant (p<0.05) differences. The Packed cell volume (PCV) was significantly higher in the following order; T₂ (30.33), T₄ (30.00), T₃ (29.00), T₁ (27.80), and T₅ (26.00). The highest significant value for PCV was obtained in T₂ (30.33), however, T₁ (27.80), was not significantly (p>0.05) different from T₄ (30.00), and T₃ (29.00), but was significantly different (p<0.05) from T₅ (26.00). All values obtained for the PCV fell within the normal range for healthy broiler chickens. Higher significant (P < 0.05) difference was also observed for lymphocytes with 5% inclusion of *Chromolaena odorata* leaf meal having the highest value (63.67%)

and the control having the least value of (56%). Treatment two (T₂) had the least value for the Heterophils (29.33%) and this was lower than the recommended normal range for healthy chickens.

Effects of Dietary Siam Weed Leaf meal (*Chromolaena odorata*) on the serum biochemical indices of broiler chickens

The serum biochemical indices of broiler chickens fed *Chromolaena odorata* leaf meal in their diets is presented in Table 3. The values obtained for the total protein, albumin, globulin, cholesterol and Glucose were not significantly different (P>0.05). The triglycerides, Aspartate Amino acids (AST) and Alanine Amino transferase (ALT) showed significant (P<0.05) differences across the treatments with the values obtained for the Triglycerides decreasing across the treatment with increasing inclusion rates of the test ingredients. T₂ (5%) had a value of 124.14mg/dL while T₅ (20%) had a value of 88.52mg/dL. Alanine

Amino Transferase (ALT) showed no particular pattern across treatments with increase in the inclusion levels of the test ingredients. The AST had an undulating

pattern with increase and decrease with increasing levels of the test ingredients across treatments.

Table 2: Effects of Dietary Siam Weed Leaf Meal (*Chromolaena Odorata*) on the Haematological Parameters of Broiler Chickens

Parameters	T ₁	T ₂	T ₃	T ₄	T ₅	SEM	P Value	Normal Range
PCV (%)	27.80 ^{ab}	30.33 ^a	29.00 ^{ab}	30.00 ^{ab}	26.00 ^b	0.55	0.01	22 - 35
HB (g/dL)	8.95	9.80	9.50	9.67	8.65	0.17	0.31	7 - 13
RBC (x10 ⁶ µl)	2.82 ^{ab}	2.89 ^{ab}	2.81 ^{ab}	3.29 ^a	2.50 ^b	0.09	0.03	2.5 – 3.5
WBC (x10 ⁴ µl)	1.43	1.39	1.42	1.53	1.39	2.83	0.65	1.2 – 3.0
Platelets (x 10 ⁵)	1.94	1.70	1.86	2.00	1.85	1.09	0.38	1.4 x 10 ⁵
Lymphocyte (%)	56.00 ^b	63.67 ^a	62.00 ^{ab}	62.67 ^{ab}	58.33 ^{ab}	0.92	0.04	48.33-61.33
Heterophils (%)	38.00 ^a	29.33 ^b	32.33 ^{ab}	31.67 ^{ab}	39.00 ^{ab}	0.98	0.01	30 - 40
Monocytes (%)	3.00	3.00	3.33	2.33	2.67	0.26	0.93	2.00–3.67
Eosinophils (%)	1.50	3.00	2.33	3.33	4.33	0.44	0.63	1.67-5.00
Basophils (%)	0.50	1.00	0.00	0.00	0.67	0.28	0.55	0.00-1.00

^{a b} Means along the same row with different superscripts are significant different. Normal range: Bounous and Stedmen (2000).

T1= control; T2=5% Inclusion of Siam weed leaf meal; T3=10% Inclusion of Siam weed leaf meal; T4=15% Inclusion of Siam weed leaf meal; T5=20% Inclusion of Siam weed leaf meal; SEM (±) = Standard error of mean.

Table 3: Effects of Dietary Supplementation of Siam weed leaf meal on the Serum Biochemistry of broiler chickens

Parameters	T ₁	T ₂	T ₃	T ₄	T ₅	SEM	P values	Normal range
Total Protein(g/dL)	4.78	4.12	3.76	3.86	4.37	0.22	0.33	4.63-4.81
Albumin (g/dL)	2.36	2.27	2.13	2.28	2.15	0.04	0.65	6.10-10.80
Globulin (g/dL)	2.35	1.79	1.63	1.58	2.22	0.23	0.02	2.00-3.50
Glucose (mg/dL)	65.14	61.04	71.44	65.05	72.60	2.67	0.14	180-250
Cholesterol (mg/dL)	160.00	128.45	123.44	141.78	158.22	7.12	0.63	125-200
Triglycerides (mg/dL)	109.26 ^{abc}	124.15 ^a	110.48 ^{abc}	92.96 ^{bc}	88.52 ^c	4.00	0.02	≤150
Creatinine (mg/dL)	0.72	0.66	0.83	1.85	0.92	0.19	0.58	1.2
AST (%)	256.01	317.21	280.78	292.14	272.23	13.12	0.68	70-220
ALT (%)	7.76 ^{ab}	9.60 ^a	8.27 ^{ab}	9.49 ^a	6.89 ^{ab}	0.49	0.04	9-43
ALP (%)	45.36 ^{bc}	54.02 ^{abc}	53.96 ^{abc}	56.09 ^{ab}	57.18 ^{ab}	1.90	0.04	92-294

^{a b c} means along the same row with different superscripts are significant different. Normal range: Bounous and Stedmen (2000). T1=Control; T2=5% Inclusion of Siam weed leaf meal; T3=10% Inclusion of Siam weed leaf meal; T4;15%Inclusion of Siam weed leaf meal; T5=20% Inclusion of Siam weed leaf meal; SEM (±) = Standard error of mean. AST-Aspartate Aminotransferase, ALT-Alanine Transaminase, ALP-Alkaline Phosphates

Effects of dietary Siam Weed Leaf Meal (*Chromolaena odorata*) on the Meat Quality Attributes of Broiler Chickens

Presented in Table 4 is the effects of dietary Siam leaf supplementation on the meat quality attributes of broiler chickens. There were significant ($p < 0.05$) differences in thermal shortening, cold shortening and water holding capacity. The thermal shortening in treatment five (T5) had the highest value (45.07%),

while T2 (5g/kg) had the lowest value (25.23%). Treatment one (control) had the lowest value (17.60) for the cold shortening, while for thaw loss T2 had the highest value (38.23) and T3 had the lowest value (28.67). Water holding capacity showed T3 having the highest value (76.00) while T5 have the lowest value (62.67) and for cooking loss T5 had the highest value (40.97) and T1(control) had the lowest value (32.33).

Table 4: Effects of dietary Siam Weed Leaf Meal on the Meat Quality Attributes of Broiler Chicken

Parameters (%)	T ₁	T ₂	T ₃	T ₃	T ₅	SEM	P value
Thermal Shortening	29.95 ^{bc}	25.23 ^c	36.60 ^{ab}	35.80 ^{ab}	45.07 ^a	1.87	0.00
Cold shortening	17.60	20.03	25.67	26.80	27.10	2.63	0.00
Thaw loss	34.13	38.23	28.67	29.87	33.67	1.73	0.70
W H C	67.33 ^{ab}	68.67 ^{ab}	76.00 ^a	70.67 ^{ab}	62.67 ^b	1.59	0.03
Cooking Loss	32.33	34.47	37.60	36.10	40.97	1.45	0.68

^{ab} means with different superscripts along the same row are significantly different. WHC- Water holding capacity

Discussion

The feed intake, average daily feed intake, and feed conversion ratio were significantly ($p < 0.05$) different. However, the best value recorded for feed conversion ratio was in T₂ (1.83) which had a 5% inclusion of COLM. This indicated better utilization of their feed. This might be as a result of the antioxidants present in Siam Weed Leaf Meal. The final weight of birds fed diets containing 5g/kg were numerically higher 1896.50 than the other birds in the other treatment. This is in line with (15) who reported that the feed conversion ratio, Initial weight, final weight, weight gain

was not significantly different ($p > 0.05$) from the birds fed composite leaf meal as alternative premix.

The lymphocytes, Heterophils, and Basophil were significantly different for the parameters assessed for the haematology of broiler chickens. All other hematological parameters evaluated, fell within the normal physiological range for apparently healthy broilers as reported by (17). This indicates that the diets were nutritionally adequate in providing a sound plane of nutrition for the birds. The non-significance of Hb values of RBC, PCV,

and Platelets within normal range, gave a clear indication of absence of anemia and feed toxicity. This further indicated that, all the birds had higher tendency to resist respiratory stress, due to the high level of Hb, the oxygen carrying pigment. (18) However, observed that *Chromolaena odorata* leaves have anti-anemic properties.

Earlier works reported by (19) and (20) postulated that the conversion of oxyhemoglobin to methemoglobin could cause poor carriage of oxygen (tissue anoxia).and this has been implicated to be the cause of sudden death of animals that accidentally fed on *Chromolaena odorata* (19). The red blood cell counts were significantly ($P>0.05$) affected by the treatment diets, with the animals on the test diets having a higher and improved values than the control group. The significant increase in RBC counts of birds fed the COLM was suggested to support immunity in several ways: improved oxygen delivery enhanced immune cell function, increased antioxidant capacity, support for neutrophil function, and modulation of inflammation. However, it's essential to note that excessive RBC production (polycythemia) can have negative effects on immunity such as: increased blood viscosity and decreased immune cell activity. The lymphocytes and heterophils were also significantly different ($p<0.05$) in this study with only the control treatment and treatment five (5) falling within the normal range as stated by (22).

The values obtained in this study were within the normal range of serum protein

4.63-4.81 g/dL reported by (22) and 5.45-6.82g/dl reported by (23). Higher values of serum protein are an indication of enzyme hydrolysis of dietary proteins; demonstrating that the blood pool serves as a major source of amino acids needed for the synthesis of proteins. The globulin showed a significant difference with the control having higher and better values than the test treatments. The result of the present study however followed a similar trend with that of (21) for total protein, albumin and albumin for laying birds fed *Chromolena odorata* leaf meal (COLM). However, the values indicated nutritional adequacy of the test material in respect of protein, hence, high serum protein and albumin values are reflection of better quality and amount of protein in the diets (17). Globulin is an indicative of high immunity and good resistance to disease in experimental animals. The declining values of globulin observed in this study with increasing levels of COLM may be attributed to COLM due to its medicinal properties; a view in disagreement with (24), (25), (26) and (27). The present findings also reveal that the Siam weed leaf meal caused a non-significant and consistent reduction in the levels of serum cholesterol, which agrees with the report of (25) which observed non-significant effect of COLM cholesterol concentration in laying birds. (28) reported that COLM significantly decreased serum cholesterol, cardiovascular complications, due to dyslipidemia conditions, hypertension and obesity. The findings of (29) reported reductions in total cholesterol, glucose and triacylglycerol when rats were fed

Chromolaena odorata leaf extract. (7) reported hypoglycemic and hypolipidemic properties of *Chromolaena odorata* leaf extract. This reduction in serum cholesterol level of broilers fed the COLM diet may suggest a general decline in lipid mobilization and maybe suggest that COLM diet was capable of reducing serum cholesterol, hence assisting in the reduction and deposition of cholesterol in the muscle; thus, enhancing the production of lean meat.

The Thermal shortening, Cold shortening, and Water holding capacity were significantly different ($p < 0.05$) It was noticed that thaw loss and cooking loss in T2 and T5 were significantly higher with decrease in nutritional value of the meat. This may be due to the manipulation of diet caused by the inclusion level of Siam Weed Leaf Meal to the feed according to (16) who reported that manipulation of feed and management are factors that determine meat quality attributes.

Conclusion

The findings from this chicken study suggest that including COLM up to 15% in broiler diets enhances hematological parameters, improves feed efficiency, and maintains meat quality. However, higher inclusion levels may lead to a decline in RBC and protein levels, indicating a threshold for optimal utilization. Future studies should focus on the long-term effects and potential bioactive components responsible for the observed changes.

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