Nigerian J. Anim. Sci. 2020 Vol 22 (2):106-113 (ISSN:1119-4308)

Efficacy of *Chromolaena odorata* (Siam weed) on performance, haematological and serum biochemical indices of broiler chicken

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Target Audience: *Agronomists, Broiler farmers, Researchers*

Abstract

A study was conducted to evaluate the effect of graded levels of Chromolaena odorata leaf extract on the performance, haematological and biochemical parameters of heat-stressed broiler chickens. A total of 120 day-old broiler chickens were randomly assigned to four treatment groups in a completely randomized design (CRD). The birds we fed graded levels of 0.0ml, 20ml, 40ml and 60ml of chromolaena odorata extract via drinking water. Data were collected on performance characteristics, haematological indices and serum biochemistry. Results from the study indicate that there were significant (P<0.05) differences on the final body weight, body weight gain and average daily weight gain as they increased progressively with increasing levels of inclusion of Chromolaena odorata leaf extract. Feed conversion ratio decreased with increasing levels of inclusion.The total white blood cell (WBC) and Lymphocyte counts of the birds were significantly (P<0.05) influenced by the treatments. There were significant (P<0.05) differences on total cholesterol and globulin glucose. Results obtained from this study revealed that the inclusion of 40ml of Chromolaena odorataleaf extract improved the growth performance as well as the health status of the birds without having any detrimental effect on the birds during thermal stress.

Key words: *Chromolaena odorata; Siam Weed; Haematology; Cholesterol; Biochemical and Performance*

Description of Problem

Poultry industry has suffered lots of setback as a result of thermal stress especially in tropical zones with environmental temperature exceeding 30^0C.To minimize the impact of heat stress, farmers have adopted different measures to ensure that the performance and welfare of the birds are improved with minimal use of synthetic drugs. Performances, haematological analyses, in combination with other biochemical methods, have been used as a physiological method to assess the health status of animals (1). The full blood count examines mostly the cellular components of blood whereas biochemical testing focuses on its chemical constituents (2). It has been shown that data from blood profiles could be exploited in the improvement of chicken stocks (3). In addition, blood parameters help diagnoses of specific female poultry pathologies and might serve as basic knowledge for studies in immunology and comparative avian pathology (4). There has been a developing controversy surrounding the use of antibiotics as growth promoters for food animals. These antibiotics are used at low doses in animal feed to control zoonotic pathogens and improve the quality of the products.

Several natural additives are now used to avoid the excessive use of antibiotics like probiotics, prebiotics, organic acids, etc., or at least reduce or substitute their inclusion in feeds, while maintaining efficient animal production to obtain safe edible products (5). Several plants and shrubs have been used as feed meal because they are safer and healthier than foods containing artificial additives.

Chromolena odorata is a scrambling perennial shrub which grows 2–3 m in height with straight, pithy, brittle stems that branch readily. The fresh leaves when applied to cuts or wounds drastically reduce bleeding (6). Dried leaves of *Chromolaena odorata* are also used as mosquito repellant, as antimicrobial agent against *Bacillus cereus* and antifungal agent against *Aspergillus niger* (7). Research has also shown that they are high in crude protein, dry matter, vitamins and minerals (8).*Chromolaena odorata* has been reported to have multipurpose medicinal properties (10). It has also been shown to possess anticancer, antidiabetic, anti-hepatotoxic, anti-inflammatory, antimicrobial, and antioxidant properties. Since (10) noted the antimicrobial and antioxidative properties of *Chromolaena odorata*, this necessitated the need to evaluate its effectiveness in promoting growth in broiler production in this study.

Materials and Methods

The experiment was carried out at the Poultry Unit of the Teaching and Research Farm of the Department of Animal Science, Ebonyi State University,Abakaliki.

Experimental materials and processing

Chromolaena odorata (Siam weed) was used in this study. It was harvested fresh from stems of maturing *Chromolaenaodorata* plants (before flowering). The leaves were plucked from stems. Aqueous extracts were obtained using 1kg of the leaves and measured with 1 liter of water. The extract was served to the birds according to the treatment specification.

Experimental birds and management

A total of one hundred and twenty-four day (124) day old broiler chicks were used for the study. The birds were fed commercial feed *ad libitum*; clean water was served to the birds for one week to stabilize them for the first week of age before adding *Chromolaena odorata* extract in their drinking water according to the treatment specification. This research work was carried out using a completely randomized design. The experiment was divided into four treatments each having three replicates. Each treatment had thirty chicks with ten chicks per replicate. Treatment 1 was the control without *Chromolaena odorata* extract, treatments 2, 3 and 4 consist of 20ml, 40ml and 60ml of *Chromolaena odorata* extract respectively. The experiment lasted for 8 weeks. Lasota and Infectious Bursal Disease Vaccines were administered at 14 and 21 days of age respectively.

The chemical composition of the *Chromolaena odorata* used in this study is presented in Table 1.

Table 1: Chemical composition of *Chromolaena odorata*

Nutrient	Wet weight	Dry weight
Moisture (%)	59.50	
Crude protein (%)	6.56	16.20
Crude fibre (%)	10.78	26.57
Ether extract (%)	0.10	0.25
Ash (%)	2.50	6.17
Nitrogen free extract (%)	2.50	50.82
Total Metabolizable Energy (kcal/100g)	109.46	270.27
Cyanogenic glycosides	0.05	0.13
Phytates	0.22	0.54
Saponins	0.80	1.98
Tannins	0.15	0.37

Source: (10)

Data collection

Data collected weekly were body weight (initial and final), weight gain, feed intake, water intake and feed conversion ratio. A weighed quantity of feed was served to the birds on replicate basis each week and the leftover at the end of the week were weighed to determine weekly feed intake. A measured quantity of water was served to the birds with the extract according to the treatment specification, the same quantity of water were kept out to determine the amount of evaporated water. Digital thermometer was used to determine the rectal temperature. Blood samples were collected randomly from the wind vein of two birds from each replicate into two bottles, one with anticoagulant and another without anticoagulant. All the samples collected with anticoagulant bottles were used to for haematological analysis to determine the packed cell volume, Haemoglobin and white blood cells differentials. The non-anticoagulant samples were used to generate serum for biochemical analysis.

Statistical analysis

Data collected were statistically analysed using Minitab version 18. Significant differences between treatment means were separated using Duncan's multiple range tests.

Results and Discussion

The results of the performance characteristics of broiler birds fed *Chromolaena odorata* extract is presented in Table 2. The results indicate that there were significant ($P<0.05$) differences in final body weight, body weight gain, average daily weight gain, total feed intake, average daily feed intake, total water intake, average daily water intake and feed conversion ratio (FCR). The rectal temperature was not significantly ($P>0.05$) affected by the treatment.

Table 2: Performance characteristics of broiler birds administered *Chromolena odorata* extract

Parameters	T_1 (0.0ml)	T_2 (20ml)	T_3 (40ml)	T_4 (60ml)	SEM
Initial body weight (g)	210.00	226.67	210.00	226.67	3.79
Final body weight (g)	1783.00^{d}	2300.00^{b}	2533.33^{a}	1820.00^{c}	0.31
Body weight gain (g)	1573.00^{c}	2073.33^{b}	2323.33^{a}	1593.33^{c}	0.11
Average daily wt gain (g)	28.08^{c}	37.02^{b}	41.48^{a}	28.45^{c}	0.11
Total feed intake (g)	1718.00^{b}	1877.44^{a}	1621.56^{c}	1752.33^{b}	6.14
Av. daily feed intake (g)	30.68^{b}	34.09^{a}	28.96^{c}	30.29^{b}	3.46
Total water intake (ml)	4018.8^{a}	3733.56^{b}	3729.78^{b}	3786.00^{b}	10.77
Av. daily water intake (ml)	71.76^{a}	66.67^{b}	66.60^{b}	67.60^{b}	1.28
Feed conversion ratio (FCR)	0.96^{a}	0.81^{b}	0.64^{c}	0.96^{a}	0.02

a,b,c,d - Means on the same row with different superscripts are significantly ($P<0.05$) different. SEM = Standard Error of the Mean

The final body weight of the birds increased progressively with the levels of inclusion of *Chromolaena odorata* leaf extract. The birds on T_3 (40ml) had the highest mean value (2533.33g) for the final body weight, followed by the birds on T_2 (2300.00g) diet, while the birds on the control diet (T_1) had the lowest mean value (1783g). The highest mean value for the body weight gain (2323.33g) was also recorded from the birds fed T_3 diet, followed by the birds fed T_2 (2073.33g) and T_4 (1593.33g) diets respectively, while the birds

on the control diet (T_1) also had the lowest value (1573.00g). Treatment one T_1 recorded the highest water intake compared to other treatment. This could be as a result of the clear nature of the water, while others had reduced water intake due to the taste of the extract.

The significant increase in the final body weight, body weight gain and average daily weight gain of the birds with the increasing levels of inclusion of *Chromolaena odorata* leaf extract could be attributed to the fact that *Chromolaenao dorata*leaf has a good potential for feeding of livestock due to its high crude protein level, and low extractible phenolic content (8). This result is in agreement with (11) who reported good performance for the weight gain at 30% dietary level of *Chromolaena odorata* leaf meal. The result is not in agreement with (12) who reported no significant differences in the final body weight as well as the body weight gain of the birds fed *Chromolaena odorata* leaf meal. This discrepancy could be attributed to high fiber content in the leaf meal which was not attributed to the extract. This result is also not in line with the findings of (13) who reported significant reduction in the final body weight and body weight gain of weaner rabbits fed graded levels of *Chromolaena odorata* leaf meal. The authors attributed the reduction in body weight of the rabbits to low feed intake which may have affected the body weight of the rabbits. Other workers (14; 15) reported low palatability of *Chromolaena odorata* leaf and attributed this to the presence of anti-nutritional factors such as tannin, cyanogenic glycosides, phytic acid and nitrate. Another researcher (16) also reported that *Chromolaena odorata* leaf contain some anti-nutritional factors (cyanogenic glycosides, phytates, saponins and tannins) which are known to cause depression in the growth of broiler chickens. The reduction in total feed intake of the birds at 40ml inclusion level of *Chromolaena odorata* leaf extract has confirmed the findings of (11),(14) and (15) who reported a decline in feed intake of broiler chickens, rabbits and albino rats fed graded levels of *Chromolaena odorata* leaf meal due to the low palatability of the leaf. The water intakes (total and average daily water intake) of the birds were found to be lower in the birds treated with *Chromolaena odorata* leaf extract compared to those on the control treatment. This is an indication that *Chromolaena odorata* leaf extract can quench thirst in birds when consumed in small amount. The decline in water consumption could be due to the salty or bitter taste of the leaf extract which made the birds less interested in drinking it (17). (18) and (19) also reported that chicks do not like drinking water that is too salty or bitter. (20) reported that water had a significant role in bird's temperature regulation through heat exchange systems and maintenance of hydric balance.. The lower feed conversion ratio (FCR) observed in the birds fed *Chromolaena odorata* leaf extract is an indication that the extract was well utilized by the birds. (20) reported that the lower the feed conversion ratio, the more the efficiency of feed utilization by animals.

Table 3 shows the results of the haematological indices of broiler birds fed *Chromolaena odorata* extract. The white blood cells in the control group is higher than those in the treatment group. The values of the control is higher than the normal range of white blood cells in typical broiler birds. The results indicate that the total white blood cell (WBC) as well as the lymphocyte counts of the birds were significantly ($P<0.05$) influenced by the dietary treatment. The result is in agreement with (13) who reported significant differences in the WBC and lymphocyte of a growing rabbit fed *Chromolaena odorata* leaf meal. The haemoglobin content, Packed Cell Volume (PCV) and Red blood cell (RBC) counts were lower in the birds fed graded levels of *Chromolaena odorata* leaf extract

compared to those on the control treatment which were above the normal range for avian species. The reduction in these parameters indicates a reduction in the oxygen-carrying capacity of the blood. The significant reduction in the total white blood cell (WBC) count of the birds fed graded levels of *Chromolaena odorata* leaf extract compared those on the control treatment suggests that the birds on control group may be susceptible to a pathological case of leucopaenia and a compromise of immune system which could predispose them to diseases (13). The highest level of lymphocyte counts recorded at 40ml (T_3) of *Chromolaena odorata* leaf extract before the slight decline in concentration observed at T_4 (60ml) diet may suggest an optimum inclusion level of 40ml which seemed to have supported a desirable health status of the birds as indicated by the haematological indices studied. (23) had stressed that higher lymphocyte and White Blood Cell (WBC) counts are associated with the ability of animals to perform well under a very stressful condition. The non-significant effect of the leaf extract on the eosinophil count of the birds was an indicator that the anti-nutritional factors present in *Chromolaena odorata* leaf did not affect the blood quality of the birds (24.)

Table3: Haematological indices of broiler birds fed graded levels of *Chromolaena odorata* leaf extract

Parameters	Normal Range	T1 (0ml)	T2 (20ml)	T3 (40ml)	T4 (60ml)	SEM
PCV (%)	23-29	35.00	29.67	27.67	27.00	1.01
Haemoglobin (g/dl)	7-10	9.53	8.13	7.27	7.27	0.28
RBC(10^{12}/L)	1-2	1.84	1.55	1.41	1.81	0.06
WBC(10^9/L)	3-5	8.13^a	4.38^b	2.93^c	3.35^c	0.26
Heterophil (%)	20-40	48.00	40.67	40.33	39.33	1.71
Lymphocyte (%)	50-70	44.00^b	54.00^a	65.00^a	60.33^a	1.11
Monocyte (%)	2-2.5	5.67	2.67	1.33	1.00	0.55
Eosinophil (%)	1-2	3.00	2.00	1.33	1.33	0.36
Basophils (%)	00	0.33	0.00	0.00	0.00	0.33

a,b,c = Means on the same row with different superscripts are significantly ($P<0.05$) different. Packed cell volume (PVC), Red blood cell (RBC), White blood cell (WBC)

Serum Biochemistry

Results of the biochemical parameters of broiler birds fed *Chromolaena odorata* extract are presented in Table 4. Results from the study indicate that there were significant differences ($P<0.05$) in the total cholesterol and globulin contents while the total protein, glucose and albumin had no significant differences. The total cholesterol is slightly lower in the treatment group while the control treatment had high level of cholesterol. This is an indication of enzyme hydrolysis of dietary protein which demonstrated that the blood pool served as a major source of amino acids needed for the synthesis of protein (25). The result is in agreement with the findings of (25) and (15) who reported significant differences in the total cholesterol, total serum protein and albumin of laying hens fed *Chromolaena odorata* leaf meal. There was also a reduction in the total cholesterol level of the birds fed 60ml of *Chromolaena odorata* leaf extract compared to other treatment groups. (26) reported reductions in the total cholesterol,

glucose and triacylglycerol when rats were fed *Chromolaena odorata* leaf extract. (27) also reported that *Chromolaena odorata* leaves significantly decreased serum cholesterol, cardiovascular complications due to dyslipidemic conditions, hypertension and obesity.

Table 4: Serum biochemical indices of heat stressed broiler chickens fed graded levels of *Chromolaenaodorata* leaf extract

Parameter	T1 (0.0ml)	T2 (20ml)	T3 (40ml)	T4 (60ml)	SEM
Total Cholesterol (mg/dl)	86.31[b]	85.50[a]	82.63[c]	77.28[a]	0/039
Glucose	192.90	191.80	190.77	171.03	5.10
Total Protein (g/dl)	3.43	3.30	3.56	3.47	0.063
Albumin (g/dl)	1.44	1.21	1.48	1.37	0.21
Globulin (g/dl)	1.99[c]	2.09[a]	2.08[c]	2.10[a]	0.0012

a, b, c = Means on the same row with different superscripts are significantly (P<0.05) different. SEM = Standard Error of the Mean.

Conclusion and Application

Based on the result of this study, it can be concluded that:

1. The inclusion of *Chromolaena odorata* leaf extracts at various levels via drinking water has resulted to improved health status of the birds.
2. The birds fed 40 ml of *Chromolaena odorata* leaf extract (T3) had better performances for all the parameters investigated compared to other levels of inclusion of *Chromolaena odorata* leaf extract.
3. Therefore, 40mls extract from *Chromolaena odorata* leaf can be included to the drinking water of broiler chickens as a remedy to heat stress.

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