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Research Article
Effect of *Eupatorium odoratum* and *Ocimum gratissimum* (Scent Leaf) Leaf Extracts on Growth, Haematology and Cost Benefit of Broiler Chickens

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Abstract

Objective: A study on the effects of *Eupatorium odoratum and Ocimum gratissimum* leaf extracts on the growth performance, haematology and cost benefit of broiler chickens were evaluated using 72 day old Anak broiler chickens in the Animal Science Department, Ebonyi State University Abakaliki, Nigeria. **Materials and Methods:** Four water infusion levels, 0, 25, 25 and 25 mL for control, *E. odoratum*, *O. gratissimum* and both leaf extracts per liter of clean drinking water designated as T_1 (control), T_2, T_3 and T_4 respectively, were used. The birds were randomly allotted to these dietary infusion levels in a completely randomized design (CRD). Each treatment was replicated 3 times with 6 birds per replicate. Feed intake, weight gain and haematological indices were determined. Economic analysis was also conducted at the end of the 4 weeks experiment. Data was analyzed by one-way ANOVA using Duncan's new multiple range test. **Results:** There were no significant ($p>0.05$) differences in the feed intake as well as weight gain and feed conversion ratio. The growth performance of the broilers fed *E. odoratum* and *O. gratissimum* were better than those fed diets without *E. odoratum* and *O. gratissimum*. There were significant ($p<0.05$) differences in the blood components of the broilers under this feeding regime. Packed cell volume (PCV), red blood cells (RBC) and white blood cells (WBC) improved with infusion of leaf extracts. **Conclusion:** The combination of the leaf extracts gave better result in growth and haematological indices of broiler chickens. These showed that the use of both leaf extracts played more significant role as anti-microbial than without *E. odoratum* and *O. gratissimum* leaf extracts in the diets of broiler chickens.

Key words: *Eupatorium odoratum*, *Ocimum gratissimum* leaf extracts, haematology, finisher broilers, performance

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Competing Interest: The authors have declared that no competing interest exists.

Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

The cost of conventional feed sources such as groundnut, fish meal and maize for non-ruminant animals in Nigeria has been on increase since the last decade[1]. This is because animal compete with humans over few available cereal grains and legumes which results to scarcity and increase in prices[1]. The growth of human and livestock population which has created increase demand for food and feed in the developing countries suggests that alternative sources must be identified and evaluated[2]. In evaluating such conventional feed resources, it is important to check the effects of such feed resources on the health status of the livestock[2]. In recent times, there is global utilization of herbal medicine in the treatment of various diseases affecting both humans and animals[3,4]. The medicinal values of many of these plants cannot be overemphasized. Some of such medicinal plants are *Eupatorium odoratum* and *Ocimum gratissimum* (Scent leaf). Researchers have identified several beneficial chemical compounds in medicinal plants. These plants may play an important role in improving production and immune system of birds against different diseases. They have strong medicinal value and could be effectively utilized as natural growth promoters to replace antibiotics and other synthetic feed additives[5,6]. Anti-inflammatory property of *E. odoratum* and *O. gratissimum* is one of the known herbaceous plants which possess chemical compounds with membrane stabilizing property. It is expected that compounds with membrane stabilizing properties should offer significant protection to cell membrane against injurious substances and thereby exhibit anti-inflammatory properties[7,8]. This notion is consistent with the observations that stabilization of biomembrane which will interfere with the early step involved in the inflammatory events, may release of phospholipase A_2 that triggers the formation of lipid mediators[9]. Studies have revealed that compounds with membrane stabilizing properties possess significant anti-inflammatory activities[10,11]. In this study, the extract of *E. odoratum* produced significant membrane stabilizing activity.

The effect may have contributed a significant role to its anti-inflammatory activity in this study. The presence of phenols, terpenoids and flavonoids in the leaf extract of some plants[12,13] may be responsible for the anti-inflammatory property demonstrated by *E. odoratum* as these phytochemicals are well known on their ability to inhibit inflammation[5,6]. Based on these medicinal properties, this research aimed at evaluating the growth performance, haematological indices and cost benefits of producing broiler chickens using *Eupatorium odoratum* and *Ocimum gratissimum* leaf extracts as alternatives to antibiotics growth promoters.

MATERIALS AND METHODS

Experimental site: This study was conducted at the Poultry Unit of Teaching and Research Farm of the Department of Animal Science, Faculty of Agriculture and Natural Resources Management, Ebonyi State University, Abakaliki between 14 July to 13 August, 2016. The site is located between latitude 06°21N and longitude 08°51E. The annual rainfall ranges from 1500-1800 mm with a temperature range from 21-30°C[14].

Experimental material: Fresh leaves of *Eupatorium odoratum* and *Ocimum gratissimum* (scent leaf) were collected within and around the premises of Faculty of Agriculture and Natural Resources Management Building, Abakaliki.

Processing method: *E. odoratum* and *O. gratissimum* leaves were collected fresh, washed and dried under room temperature while retaining the greenish coloration (25% Dry matter). They were grounded separately to leaf meals using hammer mill (2.0 mm screen size). The leaf extracts were prepared by soaking 200 g of the ground *E. odoratum* and *O. gratissimum* in warm water. One Litre of water was used to soak the leaf meal for 12 h. This preparation was carried out subsequently to obtain the leaf extract that was used throughout the period of the experiments. The proximate analysis of *Eupatorium odoratum* and *Ocimum gratissimum* was conducted using standard methods[15].

Experimental animals and infusion levels: Seventy two day old chicks were purchased from Safari Farms in Abakaliki. They were brooded and reared for 4 weeks. On the 5th week, they were weighed and randomly allotted to 4 treatment groups designated as treatments 1, 2, 3 and 4, in a completely randomized designed (CRD). Each treatment has eighteen chickens replicated 3 times with 6 chickens per replicate. The infusion levels of the leaf extracts were also designated as T_1 (0 mL without leaf extract), T_2 (25 mL of *Eupatorium odoratum*), T_3 (25 mL of *Ocimum gratissimum*) and T_4 (25 mL of both *E. odoratum* and *O. gratissimum*).

Experimental diets: The starter and finisher mash (Top feed) used for this study were purchased from Abakpa Regional Market in Abakaliki, Ebonyi State, Nigeria. Feed and water

infusion of the leaf extracts was given *ad libitum*. Other routine management practices were carried out during the study.

Parameters measured: The parameters studied include initial and final body weights, average daily feed intake and average daily weight gain, feed conversion ratio and feed cost kg^{-1} gain. At the 56th day, one chicken was randomly selected from each replicate. Blood samples were collected from their wing veins for haematological studies. The blood samples were analyzed according to their various treatment groups[16]. The haematological indices evaluated were: White blood cell count (WBC), red blood cell count (RBC), packed cell volume (PCV), haemoglobin concentration (HBC) and mean corpuscular haemoglobin concentration (MCHC).

Cost benefit analysis: A cost benefit (gross margin) analysis was carried out for the 4 treatment groups to ascertain if *E. odoratum* and *O. gratissimum* leaf extracts in the drinking water had economic benefits.

Statistical analysis: Data collected were subjected to one-way analysis of variance (ANOVA) at $p>0.05$[17] Errors were calculated as standard error of means (SEM). Significant treatment means were compared using Duncan's new multiple range test as outlined[18]. The chemical composition of *Eupatorum odoratum* and *Ocimum gratissimum* were determined by the methods[15].

RESULTS AND DISCUSSION

Nutritional values: The results of the nutritional values of *Eupatorium odoratum* and *Ocimum gratissimum* are presented in Table 1.

Growth performance: The results of the effect of *Eupatorium odoratum* and *Ocimum gratissimum* leaf extracts on the growth performance are presented in Table 2.

Feed intake and weight (g): There were no significant ($p>0.05$) differences in the initial body weight and weekly feed intake among the chickens in the 4 treatment groups. However, significant ($p<0.05$) difference was observed in the final body weight, weekly weight gain and feed conversion ratio between chickens in T_2, T_3 and T_4. Chickens in T_4 had numerically a better final and weekly weight gains than those in T_3 and T_2.

Feed conversion ratio: Chickens on T_3 had the best feed conversion ratio. The values recorded in the feed intake indicated that treatment T_4 had the highest intake value. The trend follows an increase in the levels of infusion in the drinking water, the higher the level of infusion, the higher the quantity of feed consumed by the chickens in the various treatments when compared to T_1 (control). The infusion of *Ocimum gratissimum* leaf extract in water may have introduced taste which has to do with palatability, this may have influenced intake of feed as the infusion levels increases. Although there were no significant ($p>0.05$) differences observed among the treatments (T_1, T_2, T_3 and T_4) the higher value recorded in T_4 showed that the feed was better consumed among the chickens as the infusion level increased.

The result of this study is in line with the report[19] which stated that inclusion of *E. odoratum* and *O. gratissimum* leaf meal in layers mash significantly ($p>0.05$) improved feed conversion ratio (FCR), enhanced performance in egg quality, haematological and biochemical indices. The water infusion of *E. odoratum* and *O. gratissimum* leaf meal may have induced enzymatic activities in the gastrointestinal tract thereby improving digestion and assimilation of nutrients. Alabi and Chime[19] equally reported that scent leaf has high mineral and vitamin content and can increase the digestibility of diets and consequently increase the utilization of the feed as indicated by in the feed conversion

Table 1: Nutritional values of *Eupatorium odoratum* and *Ocimum gratissimum*

Parameters (%)	*Eupatorium odoratum*	*Ocimum gratissimum*
Moisture content	80.40±0.12	82.60±0.01
Ash	11.80±0.23	13.67±0.13
Crude protein	2.72±0.02	3.33±0.07
Crude lipid	6.07±0.29	8.50±0.04
Crude fibre	10.80±0.23	9.52±0.01

AOAC[15], Errors were calculated as standard error of means (SEM)

Table 2: Growth performance of broiler chickens fed *E. odoratum* and *O. gratissimum* leaf extracts

Parameters	T_1	T_2	T_3	T_4	SEM
Initial body weight (g)	170.67	165.33	166.67	158.68	10.45
Final body weight (g)	1966.43^b	2235.15^a	2252.31^a	2380.00^a	120.12
Weekly weight (g)	232.87^b	268.20^a	282.19^a	288.67^a	15.17
Weekly feed intake (g)	659.83	680.30	703.75	728.55	51.60
Feed conversion ratio	2.84^b	2.54^a	2.49^a	2.53^a	0.10

^{a,b}Means with different superscript on a row are significantly ($p<0.05$) different, SEM: Standard error of means

Table 3: Haematological indices of broiler chickens fed *E. odoratum* and *O. gratissimum* leaf extracts

Blood parameters	T_1 (Control)	T_2 (*E. odoratum*)	T_3 (*O. gratissimum*)	T_4 (Both extracts)	SEM
PCV (%)	28.00[c]	30.66[b]	31.33[b]	33.66[a]	1.38
HB (g dL^{-1})	10.10[b]	11.80[b]	12.96[a]	14.33[a]	0.75
RBC ($\times 10^z L^{-1}$)	2.70[b]	2.81[a]	2.82[a]	2.94[a]	0.95
WBC ($\times 10^z L^{-1}$)	149.53[b]	154.43[a]	156.36[a]	158.05[a]	2.45
MCV (fl)	133.93[b]	139.43[b]	144.00[a]	148.73[a]	0.93
MCH (pg)	41.93[b]	46.60[b]	56.96[a]	58.10[a]	0.79
MCHC (%)	44.86[b]	51.06[a]	51.27[a]	52.17[a]	0.53

[a,b,c]Means with different superscripts in row are significantly different ($p<0.05$). PCV: Packed cell volume, HB: Haemoglobin, RBC: Red blood cells, WBC: White blood cells, MCV: Mean corpuscular volume, MCH: Mean corpuscular haemoglobin, MCHC: Mean corpuscular haemoglobin concentration

Table 4: Cost benefit analysis of chickens fed infusion of *E. odoratum* and *O. gratissimum* leaf extracts

Parameters	T_1	T_2	T_3	T_4
Final live weight (g)	1966.43	2236.15	2352.31	2380.00
Total weight gain (g)	1795.76	2069.82	2185.64	2221.33
Total feed consumed (g)	5090.12	5249.03	5428.93	5620.24
Cost/kg feed (N)	110.00	110.00	110.00	110.00
Cost/kg feed consumed/bird (N)	559.91	577.39	597.18	618.23
Cost of feed/kg gain (N)	311.80	278.96	273.23	280.32
Cost of production (N)[a]	822.91	835.97	904.05	905.77
Revenue (N)[b]	1474.82	1676.36	1764.23	1785.00
Benefits (profit) (N)	651.91	835.97	904.05	905.77
Cost benefit ratio	1.26	1.01	0.95	0.98

[a]Cost of production = Cost of feed+Cost of medication+Cost of day old chicks. [b] Revenue based on N750 kg^{-1} live weight

ratio. Al-Harthi[20] also reported improved growth performance of broiler chickens fed *O. gratissimum* contrary to who observed that inclusion of *O. gratissimum* as feed additive did not improve weight gain and feed/gain ratio in finisher broiler chickens.

Haematological analysis: The haematological indices of the broiler chickens fed T_1 (control) and those of T_2, T_3 and T_4 fed leaf extracts infusions are shown in Table 3.

The mean haemoglobin (HB) concentration and packed cell volume (PCV) of the birds on T_4 of the leaf extract were significantly ($p<0.05$) higher than other treatment except T_1 groups which were significantly ($p<0.05$) lower than T_3 and T_2. Total white blood cell (WBC) counts of the birds in T_4 were similar ($p>0.05$) but higher than those of T_2, T_3 and T_4 numerically. The HB, PCV and WBC result agreed with the reports of Nwinyi *et al.*[21] and Obiamimo *et al.*[22], who observed a significant ($p<0.05$) improvement in feed conversion ratio. This improvement could be associated with a better utilization of feed which facilitated higher nutrients absorption that leads to higher haemoglobin concentration and higher percentage PCV.

Umukoro and Ashorobi[4] report showed that decreased HB and PVC with *O. gratissimum* leaf extracts in haematological components of male mice. The RBC counts of the chickens in this study were similar ($p>0.05$) with those of T_1. It is noteworthy to observed from the RBC counts that *Ocimum gratissimum* and *Eupatorium odoratum* infusion was significantly ($p<0.05$) different better than the control. This shows that *E. odoratum* and *O. gratissimum* leaf extract was a red blood cell booster. This could be responsible for the stability in the body condition of the chickens. It may also have contributed to the stability of the homeostatic control mechanism to had maintained similar counts of RBC. This is in line with Mohammed *et al.*[23], who fed about 40%, of *O. gratissimum* to Wister rat and recorded significantly ($p<0.05$) higher RBC, WBC and HB concentration.

Cost benefit: The result of the cost benefit analysis of the infusion of *Eupatorium odoratum* and *Ocimum gratissimum* leaf extract in the drinking water is presented in Table 4.

However, the cost of feed/kg body weight gain was least for birds on T_3 (N273.23) while those on control had the highest cost (a difference of up to N38.57), although T_4 gave the highest revenue (N1785.00), the best profit (benefit) were obtained from chickens on treatment 3 (T_3) (a gross margin of 0.28 k between T_3 and T_4. The least revenue (N1474.82) was obtained in T_1. The cost benefit ratio which is the ratio of the cost of the production expressed in monetary term relative to its benefits also expressed in monetary term was highest (1.26) in T_1 and least (0.95) in T_3. This indicates that T_3 was better for the study since the lower the cost, benefit ratio, the more economically effective the diet. As at the period of this study, 1 USD = 485 NGN.

CONCLUSION

In conclusion, the use of *Eupatorium odoratum* and *Ocimum gratissimum* in the diet of broiler chickens was good. It increased profitability and improved blood components, it's inclusion in feed or through water can be used to control gut pathogenic organisms and therefore, is recommended for dietary intake through water.

SIGNIFICANCE STATEMENT

This study discovers the possible synergistic effect of both mineral elements and vitamins such as calcium and vitamins E and D combination that are beneficial for bone calcification and bone marrow production. There will be possible replenishment of blood cells in the body through the use of these leaf extracts. The discovery of the role played by the use of this important herbaceous plant leaf extracts in growth and development of blood cells has paved way for a new discovery in Medical Science.

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