Effect of *Vernonia amygdalina* (Bitter Leaf) Extract on Growth Performance, Carcass Quality and Economics of Production of Broiler Chickens

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ABSTRACT
Vernonia amygdalina (bitter leaf) is a shrub or small tree that grows throughout tropical Africa. It is a very important protective food and useful for the maintenance of health and treatment of various diseases. The purpose of this study is to determine the effect of Vernonia amygdalina (VA) extract on growth performance, carcass quality and economics of production of broiler chicks.
Sixty 7- day old Oba-Marshall broiler chicks were used for 54 days water infusion feeding trial. Four water infusion levels 0ml, 25ml, 50ml and 75ml of VA per litre of (clean) drinking water designated as T_1, T_2, T_3 and T_4 were used. Birds were randomly assigned in a completely randomized design (CRD) experiment with each treatment replicated three times (5 birds per replicate), daily feed and water were offered ad libitum. Data were collected on feed intake, weekly body weight and economics of production. The result showed that there was no significant ($p>0.05$) difference in weekly feed intake of birds among the four treatments, T_1, T_2, T_3 and T_4. Significant ($p<0.05$) differences were observed in the final body weight, weekly weight gain and feed conversion ratio of birds among the treatments. The result for carcass quality showed significant differences ($p<0.05$) in slaughtered weight, carcass weight, carcass dressing

percentage, drum stick, thigh, breast, giblets and back but no significant ($p>0.05$) difference was observed in wing, abdominal fat, head, intestine length and intestine weight. There was decreased mortality of broilers fed 50ml and 75ml of VA. Birds on T_3 (50%) had the best feed conversion ratio (2.49%) and least cost benefit ratio. It can be concluded that the birds fed 50% (T_3) and 75% (T_4) infusion level gave better result, highest revenue and can be recommended to achieve better feed conversion ratio, weight gain and carcass quality.

Keywords: *Vernonia amygdalina; growth performance; carcass characteristics; economics of production.*

INTRODUCTION

One of the profitable agro-industries which can effectively tackle the problems of unemployment in the rural areas is the poultry sector (Singh, 2010). Poultry industry can be adopted under a wide range of climatic conditions and can generally be combined conveniently with other farm enterprises. Despite the low growth in the poultry sector for the past two decades, a huge gap exists between availability and requirement of poultry products (Singh, 2010). It is a common knowledge that feed constitute the greatest and most costly input in any livestock farm; especially poultry. Thus, any significant reduction in the cost of feeds will significantly reduce the overall cost of production and increase the profit margin of the farm (Owen and Amakiri, 2011). Due to high cost of the conventional protein ingredients like fish meal, groundnut cake and soybean, the trust of nutritional research is now towards identifying non-conventional sources that are locally available with low human demands (Owen *et al.,* 2009). One of such conventional feed sources that could be used to reduce the high cost of conventional protein sources in livestock diets with particular reference to poultry is the bitter leaf (*Vernonia amygdalina)* meal.

Vernonia amygdalina (*VA*) is a shrub or small tree that grows throughout tropical Africa. It is popularly called bitter leaf because of its abundant bitter principles (Ekpo *et al.,* 2007). The leaves contain a considerable amount of anti-nutritive factors like high level of tannic acid and saponin (Charles and Boulevard, 2012). The findings by Akwaowo *et al., (*2000) reported that the young leaves often preferred for human consumption, contain high cyanide (60.1mg 100^{-1}g DM) and tannin content (40.6mg 100^{-1}g DM) than older ones. Proximate composition of *Vernonia amygdalina* leaf meal (VALM) shows a chemical composition of 527.83 ME kcal/ kg, 86.40% DM, 21.50% CP, 13.10% CF, 6.80% EE, 11.05% Ash, and the result on mineral composition indicate that *V. amygdalina* has 3.85% Calcium, 0.40% Magnesium, 0.03% Phosphorus , 0.006% Iron, 0.33% Potassium and 0.05% Sodium (Owen, 2011). Furthermore, *Vernonia amygdalina* has also been fed to broilers, where it was able to replace 300g kg^{-1} of maize-based diet without negative effect on feed intake, body weight gain and feed efficiency (Bonsi *et al.*, 1995).

Research has shown that *V.amygdalina* have some beneficial effects in disease management of poultry Dakpogan (2006), such as anti-coccidiosis, anti-bacterial and anti-parasitic (Gbolade, 2009; Tadesse *et al.*, 1993); as an anti-oxidant (Erasto *et al*., 2007) and as a growth promoter by enhancing the gastro intestinal enzymes thus increasing feed conversion efficiency (Huffman *et al.*, 1996; Olobatoke and Oloniruha, 2009).

Therefore, the objectives of this study were to evaluate and determine the effect of different levels of bitter leaf extract on growth performance and carcass quality of broiler chicks, and also evaluate the economics of production of using bitter leaf extract in raising broiler chicks.

MATERIALS AND METHODS

Experimental site

This study was conducted at the Poultry Unit of Teaching and Research Farm in the Department of Animal Science, Faculty of Agriculture and Natural Resources Management, Ebonyi State University, Abakaliki.

Sources and preparation of materials

Fresh bitter leaves were purchased from Abakaliki main market in Ebonyi State. The leaves were dried under room temperature while retaining the greenish coloration, and then ground into meal. The bitter leaf extract was prepared by soaking 50g of the ground bitter leaf meal in 1 litre of boiled hot water overnight (12 hours). This was filtered in the morning and measured quantity of filtrate according to the experimental treatment added to one liter of pure drinking water and served to the birds. The treatment was available on daily basis.

Experimental birds and management

Sixty day old Oba-Marshal broiler birds purchased from a reputable distributor in Abakaliki were used for the study. The birds were assigned randomly to four treatments designated T_1 - 0ml, T_2 - 25ml, T_3 - 50ml, and T_4 - 75ml with each treatment having fifteen birds. Each of the treatment was replicated three times, with five birds per replicate in a completely randomized design (CRD). The experiment lasted for a period of 54 days. The chicks were electrically brooded for 1 week in a deep litter system during which time they were fed commercial broiler starter diets (Top feed) till 4 weeks while finisher diet were given from 5 week to the end of the experiment. Prior to the commencement of the experiment, the birds were weighed to obtain their initial body weights and subsequently weekly.

Feed intake was recorded daily as the difference between the feed offered and the leftover. Feed conversion ratio was calculated as the total feed consumed divided by the body weight gain. Vaccination and other routine poultry management practices in the tropics which include daily inspection of the birds for symptoms of diseases, mortality, cleaning of troughs and supply of feed and fresh water were maintained (Oluyemi, 2000).

Data collection

Data were collected on the following growth performance traits (body weight gain, weekly body weight, and daily body weight gain), feed intake and feed conversion ratio.

Carcass evaluation

At the end of the experiment, one bird was selected from each replicate (three birds per treatment). The selected birds were weighed and deprived of feed but not water for 12 hours. They were weighed and slaughtered through cervical dislocation followed by exsanguinations. Dressing percentage was obtained as a percentage of the dressed weight after removing the feathers. They were then eviscerated for carcass yield and organ weight determination. The carcass yield and organ weights were weighed and calculated as percentage of the dressed weight.

Economics of production

A cost-benefit (gross margin) analysis was carried out such as cost of production (cost of feeding, procurement of birds, labor and medication). The revenue was based on ₦750 per kg live weight of birds during the time of the experiment.

Statistical analysis

Data collections were subjected to one way analysis of variance (ANOVA) using SPSS version 19 for windows and significant means were separated using F-LSD at 5% significance level.

RESULTS

The birds were fed commercial broiler starter and finisher diets (Top Feed) the proximate composition of feed as on the label is presented in Table 1

Table 1. Proximate Composition of Diets

Nutrient	Starter	Finisher
Crude Protein	22.00	18.00
Fat /oil	6.00	6.00
Crude Fibre	5.00	5.00
Calcium	1.00	1.00
Available Phosphorus	0.45	0.40
Lysine	1.20	0.85
Methionine	0.55	0.35
Salt	0.30	0.30
ME(kcal /kg	2900	2900

Growth performance traits

The result of the effect of bitter leaf extract on the growth performance of broiler chickens is presented in Table 2. The results depict that there were no significant ($p > 0.05$) differences observed in the initial body weight and weekly feed intake among the treatments. However, significant ($p < 0.05$) differences were observed in the final body weight, weekly weight gain and feed conversion ratio between T_1 and other treatments (T_2, T_3 and T_4).

Table 2. Growth performance characteristics of broiler chicks fed bitter leaf extract

Treatment / Parameter	T_1	T_2	T_3	T_4	SEM
Initial body weight (g)	170.67	165.33	166.67	158.67	10.45
Final body weight (g)	1966.43^{b}	2235.15^{a}	2352.31^{a}	2380.00^{a}	120.12
Weekly weight gain (g)	232.87^{b}	268.20^{a}	282.19^{a}	288.67^{a}	15.17
Weekly feed intake (g)	659.83	680.43	703.75	728.55	51.6
FCR	2.8^{b}	2.54^{a}	2.49^{a}	2.53^{a}	0.10

^{a,b} *Means on the same row followed by different superscript are significantly different ($p<0.05$)*

FCR – Feed Conversion Ratio

Carcass quality

The results of the carcass quality of the birds given 0, 25, 50 and 75 ml of bitter leaf extract are shown in Table 3. There were significant variations ($p<0.05$) between the experimental treatments in slaughtered weight, carcass weight, dressing percentage, drum stick weight, thigh weight, breast weight, back weight and giblets weights, especially, between T_1 and other treatments.

Table 3. Effect of bitter leaf extract on carcass quality of broiler chicks

Treatment / Parameter	T1	T2	T3	T4	SEM
Slaughtered weight(g)	1633.33^{c}	1900.00^{b}	2216.67^{a}	2166.07^{a}	278.39
Carcass weight(g)	1233.33^{c}	1516.67^{b}	1777.33^{a}	1816.67^{a}	204.18
Dressing percentage	75.92^{c}	79.80^{b}	80.02^{b}	83.87^{a}	1.16
Drumstick(g)	150.00^{b}	186.00^{a}	213.67^{a}	241.67^{a}	28.37
Thigh(g)	177.00^{c}	264.00^{b}	305.67^{a}	274.66^{a}	56.46
Wing(g)	131.67	179.67	178.33	196.33	23.79
Breast(g)	281.33^{c}	332.67^{b}	433.67^{a}	429.00^{a}	58.86
Giblets(g)	136.00^{c}	173.00^{b}	203.00^{a}	200.00^{a}	24.52
Abdominal fat(g)	58.00	54.67	71.33	72.33	13.19
Head(g)	40.33	47.33	42.00	51.33	6.00
Back(g)	201.00^{c}	212.67^{bc}	303.67^{a}	318.00^{a}	43.59
Intestine length(cm)	37.67	81.33	85.00	55.67	16.58
Intestine weight(g)	101.33	173.67	187.33	146.33	20.03

^{a,b,c} Means on the same row followed by different superscript are significantly different ($p<0.05$)
*Giblets – Heart, liver, gizzard and neck.

Economics of production

Table 4 as presented is the result of economics of production of the inclusion of bitter leaf aqueous extract on broiler chickens.

Table 4. Cost-benefit analysis of inclusion of bitter leaf aqueous extract

Parameters	T_1	T_2	T_3	T_4
Final live weight (g)	1966.43	2235.15	2352.31	2380.00
Total weight gain(g)	1795.76	2069.82	2185.64	2221.33
Total feed consumed(g)/bird	5090.12	5249.03	5428.93	5620.24
Cost /kg feed	110	110	110	110
Cost/kg feed consumed/bird	559.91	577.39	597.18	618.23

Cost of feed/kg weight gain	311.80	278.96	273.23	279.32
Cost of prod.(₦)	822.91	840.39	860.18	881.23
Revenue (₦)	1474.82	1676.36	1764.23	1785.00
Benefits (profit) (₦)	651.91	835.97	904.05	903.77
Cost-benefit Ratio	1.26	1.01	0.95	0.98

Cost of production = Cost of feed + Cost of medication + Cost of day old chick. Revenue based on ₦ 750/kg live weight

DISCUSSION

The results of growth performance characteristics of broiler chicks fed bitter leaf extract as presented in Table 2 indicated that T_4 had numerically better final body weight and weekly weight gain than T_3 and T_2 while birds on T_3 had the best feed conversion ratio. The result pertaining to feed intake had the highest numerical value in T_4 but showed no significant difference. The result pertaining FCR of this study is in line with the findings of Olobotoke and Oloniruha (2009) who reported that inclusion of *VA* powder in cockerels feed significantly improved FCR. This could be associated with its effect on enhancing the gastro intestinal enzyme thereby improving digestion and assimilation of nutrients (Adaramoye *et al.*, 2008). The findings by Windisch (2007) also reported improved growth performance of animals fed *VA*. Furthermore, the report of Mohammed and Zakariya (2012) supported the observations made by Abubakar *et al*., (2010) that phytogenic feed additives are often associated to the improvement of flavor and palatability of feed, thus bitter leaf extract enhances production performance of birds. However, the observations made by Mohammed and Zakariya (2012) pertaining improvement of weight gain and FCR in broilers are in contrary with the present result. This may be attributed to the levels of inclusion of *VA* in diet and genotype by environment interaction effect of the animals in different locations.

The results of the carcass quality of the birds given 0, 25, 50 and 75 ml of bitter leaf extract are shown in Table 3. Most of the parameters for T_3 and T_4 are comparable. However, T_3 and T_4 had higher values in some of the parameters when compared to T_1 and T_2. The results of the present study are in accordance with the report of Abubakar *et al.*, (2010) who observed variation in carcass characteristics of broiler birds fed varying levels of garlic. The values for dressing percentage were significantly higher in T_4. The values of dressing percentage obtained in this study are comparable to the observations made by Nweze and Nwankwagu (2010) for broilers fed diets containing *Tetrepleura tetraptera*. The findings by Tarek *et al.*, (2013) reported no significant difference on thigh, drum stick, wings, breast and back on birds fed olive leaf extract. This may be as a result of different leaf extract of shrubs used. The significant ($p<0.05$) higher dressing percentage of birds on T_3 and T_4 in this study confirms a better and most efficient utilization of nutrients in terms of digestion, absorption and assimilation as reported by (Bamgbose *et al.*, 1999). According to the results by Odoemelam *et al.*, (2013), the inclusion of bitter leaf in broiler diets leads to improvement in body weight, dressing percentage and significantly promoted higher dressed weight and carcass quality.

The values for thigh, breast and back were significantly higher for birds fed diet (T_3) and (T_4) compared to other treatments. This implies better profitability of birds placed on treatment T_3 and T_4 than others, since these are highly priced cut parts.

Table 4 as presented is the result of economics of production of the inclusion of bitter leaf aqueous extract on broiler chickens revealed that the cost/kg feed consumed/bird as well as cost of production increased with increase in the quantity of *VA* in the drinking water.

However, the cost of feed /kg body weight gain was least for the birds in T_2, T_3 and T_4 while those in T_1 had the highest cost. Although T_4 gave the highest revenue, the beset profit (benefit) were obtained from birds on T_3 while the lowest revenue 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 in T_1 while the least were obtained in T_3 and T_4. This indicates that T_3 and T_4 were better for the study since the lower the cost-benefit ratio, the more economically effective.

Conclusion and recommendation

The use of bitter leaf in the production of broiler had no detrimental effect on the performance of broilers. However, bitter leaf meal given at 50ml and 75ml per litre of drinking water numerically enhanced the growth rate of the birds. Based on the principle of economics of production it would be advisable to supplement bitter leaf meal in drinking water of broilers because it proved to be economically better. Bitter leaf meal can be used in feeding broilers because it has no negative effect on growth performance and carcass traits. Finally more research needs to be done to establish a precise amount, age and other conditions under which better result can be achieved in the use of bitter leaf.

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