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Effect of Basil Leaf (*Ocimum gratissimum*) Supplement on Performance and Carcass Characteristics of Growing Pullets

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Abstract

The performance and carcass characteristics of Growing Pullets (GP) fed basil leaf (*Ocimum gratissimum)* (OG) supplement was studied for 8 weeks using eighty-four 13 weeks old Nera Black GP. The birds were maintained on growers diet supplemented with 4 levels of basil leaves supplement(BLS) (0, 5, 10 and 15g/bird) for treatments A, B, C and D, respectively at 3 days interval throughout the period of experiment. Each treatment was replicated thrice with seven birds per replicate in a completely randomized block design. Treatment A served as control. The birds were fed the same growers diet. Feed and water were served *ad-libitum*. Data were subjected to Analysis of Variance (ANOVA) and comparisons made using Duncan's Multiple Range Test. The results of the experiment showed a significant ($p<0.05$) treatment effects in total feed intake, feed conversion ratio (FRC) and number of eggs laid, final live weight (FLW) and mean body weight gain (MBWG). Similar scenario was observed in dressed, breast, thigh, plucked weights and egg follicle formation. Birds in control had the highest total feed intake (TFI) (6671.55 g) and MBWG (523.84 g) compared to other treatments (B, C and D) whose values were 6644.27, 6640.29 and 6152.67 g for TFI and 483.34, 500.00 and 445.24 g for MBWG, respectively. The cost of feed consumed was best on birds fed 15gBLS (N353.04/bird) while the highest number of eggs laid was recorded in birds served 5 g(83) and 15gBLS (77) with reference to control (57). Birds served 5-15g BLS had increased liver weight (26.01, 25.01 and 27.42 g) compared to control (24.38 g), while those fed 15gBLS had reduced dressed weight (DW) (952.50 g). The best egg follicle formation was recorded on those served 5g BLS/bird. There was progressive reduction in MBWG, TFI and egg follicle with increasing weight of OG, unlike FRC and liver weight, which increased linearly. Therefore, the GP are recommended to be served 5-15gBLS/bird and later reduced to 5gBLS/bird at 3 days interval when the GP had come up to 15-20% in lay, in order to minimize further loss in weight and to improve egg follicle formation.

Keywords: performance, carcass characteristics, growing pullets, basil leaf, supplement

1. Introduction

In the view of the growing rate of population in developing countries including Nigeria, there is need for increase in animal performance and protein intake. The drive for attainment of self-sufficiency in meat and animal products in Nigeria calls for total exploitation of the potential sources of animal protein to ensure a satisfactory level of human protein nutrition. FAO (2015) reported high level of malnutrition in developing countries of the world. Animals in captivity can equally be served aqueous-heated or fresh form of some of the tropical vegetables for minerals, hormones, vitamins, protein and energy supplements, especially during the dry period of the year in the humid tropical environment for improved growth rate and blood formation (Nworgu et al., 2013). Improvement in performance and body conformation in poultry had mainly come as a result of genetic selection, but control of nutritional and rearing factors has also played a part (Berri, 2000). Sirwan et al. (2012) reported that smallholder farmers use alternative plant protein sources due to high cost of conventional feed ingredients in the tropics and subtropics. Several poultry scientists all over the world are now actively engaged in research into the use of botanicals and plant derived products to fight and reduce the heavy economic losses in poultry industry caused by poultry diseases (Abbas et al., 2012).

The demand for animal protein for human nutrition in developing countries of the global village is still on the increase (OCED and FAO, 2010).

In Nigeria, the poultry sector has turned into a promising and dynamic industry with potentials for economic empowerment, poverty reduction, employment and income generation and reduction in youth restiveness. However, major problems of poultry production in Nigeria are high cost of feed ingredients and feeds, poor quality feeds, high cost of day old chicks and poultry diseases (Akintunde & Adeoti, 2014). Feed cost accounted for 70% of the total costs of production for poultry in Nigeria (Oladokun & Johnson, 2012). In order to reduce the high cost of feeding the birds and at the same time maintain the quality of the feeds, there is need to feed the growing pullets with basil leaf supplement. Basil leaf is available in Nigeria throughout the year because it is a perennial crop. Over the past few years' aromatic plants and their extracts have been used in animals' diets as feed additives in order to improve their performance, health and the quality of their products. This use of aromatic plant is based on the wide range of their antimicrobial, antioxidant, anticoccidid properties, as growth promoters and feed additives (pro-biotics) (Christaki & Bonos, 2012; Zeng et al., 2013).

Basil leaf (*Ocimum gratissimum*) is a widely used local plant in the tropics of Africa and Asia for both nutritional and therapeutic purposes. It prefers moist and fertile soils during growth, but will tolerate drought after flowering. To ensure more net returns and to minimize high expenditure on feed, many research strategies have been practiced such as introducing feed supplement and feed additives (Christaki & Bonos, 2012). Nweze and Ekwe (2012) concluded that *Ocimum gratissimum* leaf extracts can be used to improve growth performance, stabilize the blood components and reduce the gut and blood micro-organisms for finishing broilers.

Carcass quality and organs weight of broilers decreased with decreased feed quality. Hajati (2010) reported that supplementation of diets with 500mgkg^{-1} multi-enzyme improved feed to gain ratio, carcass yield and some metabolites in blood, but could not have significance on carcass composition. Genetic selection for edible meat yield will intensify as a result of market demand. In Nigeria, basil leaf is found throughout the year, although its yield in dry season is lower compared to raining season. Utilization of basil leaf in livestock nutrition has not been widely and scientifically exploited. The use of basil leaf in growing pullets will increase the knowledge for the search for natural herd and reduce cost of production. Hence, the objective of this project was to evaluate the effect of basil leaf (*Ocimum gratissimum)* supplement on growth rate and carcass characteristics of growing pullets.

2. Materials and Methods

An 8-week experiment was carried out from 23rd of December 2010 to 12th of February, 2011 in the Federal College of Animal Health and Production Technology, Institute of Agricultural, Research and Training, Ibadan, Oyo State, Nigeria. Ibadan is located on Longitude 03^{o}51'E, Latitude 07°23'N, Altitude 650m and lies in the humid zone of South-Western Nigeria. The mean annual rainfall was 1485 mm, with a mean monthly temperature of 24.8°C and relative humidity of 65.4% within the months of the experiment. Eighty-four growing pullets (Nera Black Breed) of 13 weeks old were allowed to acclimatize for 2 weeks during which the birds were fed a commercial growers diet prior to the commencement of the experiment. After acclimatization, the birds were weighed and randomly allotted into four dietary treatments, A, B, C and D which contained 0,5,10 and 15g/bird basil leaves supplement (BLS), respectively in a completely randomized block design. Each treatment was replicated thrice with 7 birds per replicate. Treatment A served as control. The basil leaves and seeds were harvested a day prior to the usage, washed and spread on platform overnight.

The leaves were detached from the stem and stems were discarded. The leaves were chopped into small pieces using sharp knife and chopping board. The chopped leaves were offered to the birds based on the treatments in separate feeding troughs at 3 days interval. The birds were fed the same growers mash (Table 1). Feed and water were served *ad-libitum*. Required vaccination and drugs were given as at and when due. Feed and water intake data were collected on daily basis, weight gain on weekly basis, while feed conversion ratio (FCR) was calculated at the end of the experiment. The cost of feed per kilogram live weight gain (CFPKLWG) was calculated based on cost of feed per kg, feed intake and weight gain. Standard carcass procedures were employed for dressed carcass of growing pullets (Broadbent et al., 1981). At the end of the eight-weeks of the trial, six birds per treatment were randomly chosen and starved for six hours in order to enable the birds discharge their intestinal contents so as not to affect the carcass weight and to avoid contamination. The birds were weighted and later slaughtered by the method of Broadbent et al. (1981) and thoroughly bled. The carcasses were defeathered, eviscerated and cleaned. The weights and lengths of various parts and organs were determined. An economic appraisal of the study was carried out. Data collected were subjected to Analysis of Variance (ANOVA), errors were calculated as standard error of means (SEM). Significant treatment means were compared

using Duncan's New Multiple Range Test as outlined by Obi (1990). The proximate and chemical composition of the experimental diet and basil leaf were determined by the methods of AOAC (1990).

Table 1. Gross composition of growers mash (%)

	Treatments			
Ingredients	A * (*0.0gBLS/bird)	B (5.0gBLS/bird)	C (10.0gBLS/bird)	D (15.0gBLS/bird)
Maize (yellow)	40	40	40	40
Corn bran	16	16	16	16
Wheat offal	10.19	10.19	10.19	10.19
Palm kernel cake	10	10	10	10
Soyabean meal	10	10	10	10
Groundnut cake	6	6	6	6
Fishmeal (72%)	2	2	2	2
Bone meal	3	3	3	3
Oyster shell	2	2	2	2
Salt	0.25	0.25	0.25	0.25
Premix	0.25	0.25	0.25	0.25
Lysine	0.2	0.2	0.2	0.2
Methionine	0.11	0.11	0.11	0.11
Calculated analysis				
Crude protein	16.62	16.62	16.62	16.62
Crude fibre	4.51	4.51	4.51	4.51
Ether extract	3.99	3.99	3.99	3.99
Calcium	2	2	2	2
Phosporus	0.69	0.69	0.69	0.69
Methionine	0.47	0.47	0.47	0.47
Lysine	0.82	0.82	0.82	0.82
Metabolisable energy(Kcal/kg)	2851	2851	2851	2851
Determined analysis				
Crude Protein				
Crude fibre				
Fat	18.06	18.06	18.06	18.06
Nitrogen free extract	5.56	5.56	5.56	5.56
Ash	4.13	4.13	4.13	4.13
Dry matter	55.42	55.42	55.42	55.42
+Metabolizable energy(Kcal/kg)	7.69	7.69	7.69	7.69
	90.86	90.86	90.86	90.86
	2873	2873	2873	2873

*; BLS = Basil Leaves and Seeds; + ME = Calculated according to Panzenga (1985).

3. Results

The determined proximate composition of the growers diet used in this study is presented in Table 1. The proximate and chemical composition of the *Ocimum gratissimum* (OG) indicated that it is low in (CP) in both its leaves (6.38%) and seeds (6.21%), crude fat in seeds (2.76%), but relatively high in crude fibre (CF) (18.52 and 23..44%) for leaves and seeds, respectively. The concentrations of phosphorous, zinc and iron in both seeds and leaves are adequate (Table 2). The concentrations of tannin, oxalate and phytate in the basil leaves and seeds were very low.

Hence, BLS is a valuable feed supplement for GP, most especially during the dry season of the year.

Table 2. Proximate and chemical composition of basil leaf (*Ocimum gratissimum)* (% DM Basis)

Parameters	Leaves	Seeds
Crude protein	6.38	6.21
Crude fibre	18.52	23.44
Crude fat	5.89	2.76
Ash	12.24	3.41
Dry matter	91.97	91.86
Moisture content	8.03	8.41
Nitrogen free extract	48.94	56.04
Calcium	7.02	4.48
Phosphorus	0.24	0.28
Potassium	0.09	0.12
Magnesium	0.5	0.25
Sodium	0.06	0.08
Zinc (mg/kg)	139.04	182
Copper (mg/kg)	11.01	12.99
Iron (mg/kg)	282.05	395.85
Manganese (mg/kg)	33.12	40.08
Tannin (mg/kg)	750.00 (0.075%)	760.00 (0.076%)
Oxalate (mg/kg)	1030.00 (0.103%)	760.00 (0.076%)
Phytate (mg/kg)	2150.00 (0.215%)	890.00 (0.089%)

Performance of growing pullets fed BLS is presented in Table 3. The birds significantly ($p<0.05$) responded to the dietary inclusion of BLS in all the parameters measured across the treatments except for average daily water intake (ADWI) which was not significant ($p>0.05$). The final live weight (FLW) varied 1490.48g/bird in birds fed 5gBLS to 1438.10g/bird for the birds fed 15gBLS. Similar trend was observed in weight gain which was best in control (523.84g/bird) and least in the birds served 15gBLS (445.24 g). This indicates that the BLS is a potent hypolipidaemic agent and can be good for diabetic patients. The cost of feed per kilogram live weight gain (CFPKLWG) was best in control (N730.38 kg^{-1}) unlike the GP fed 15gBLS/bird (N792.92). This scenario is associated with the lower WG of GP fed 15gBSL (Table 3).

Table 3. Performance of growing pullets fed basil leaf supplement

	Experimental diets				
	A	B	C	D	SEM
Parameters	0.0gBLS/bird	5.0gBLS/bird	10.0gBLS/bird	15.0gBLS/bird	
Initial live weight(g/bird)	964.26	1007.14	990.48	992.86	-
Final live weight (g/bird)	1488.10^{a}	1490.48^{a}	1490.48^{a}	1438.10^{b}	7.12
Mean body weight gain(g/bird)	523.84^{a}	483.34^{c}	500.00^{b}	445.24^{d}	8.7
Average daily weight gain(g/bird)	9.35	8.63	8.93	7.95	-
Total feed intake (g/bird)	6671.55^{a}	6644.27^{a}	6640.29^{a}	6152.65^{b}	80.49
Average daily feed intake(g/bird)	119.13^{a}	118.64^{a}	118.57^{a}	109.86^{b}	1.44
Feed conversion ratio (FCR)	12.74^{b}	13.75^{a}	13.28^{a}	13.82^{a}	0.28
Total water intake (ml/bird)	15414.4	15743.3	15892.8	15362.5	
Average daily water intake (ml/bird)	275.25	281.13	283.79	274.34	149.69
Feed water intake ratio	01:02.3	01:02.4	01:02.4	1:2.50	2.83
Cost of feed (N/kg)	57.38	57.38	57.38	57.38	-
Cost of feed consumed (N/bird)	382.81	381.25	318.02	353.04	-
Cost of Feed per kg live weight gain (CFPKLWG)(N/bird)	730.78	788.78	762.04	792.92	-
Cost of basil leaf (N/bird)	-	2.8	5.6	8.4	-
Relative cost advantage of basil leaf and cost of feed per kg live weight gain (CFPKLWG)	-	-60.8	-36.86	-70.54	-
Number of eggs laid (in days)	57.00^{c} (13dys)	83.00^{a} (26dys)	59.00^{c} (26dys)	77.00^{b} (29dys)	3.42
Survivability (%)	100	100	100	100	-

abcd: Means with different superscripts on the same horizontal row differ significantly ($p<0.05$). BLS = Basil Leaves Supplement Dys = days.

The number of eggs laid in 16 days was best in GP served 5g (83 eggs) and 15gBLS (77 eggs) compared to control (57 eggs).

Carcass indices of growing pullets fed BLS are shown in Table 4. It depicts that the GP fed 15gBLS/bird had the least values of plucked and dressed weights which were significant ($p<0.05$) from the other treatments.

Table 4. Carcass characteristics of growing pullets fed basil leaf supplement

	Treatments				
	A	B	C	D	SEM
Parameters	(0.0 BLS/bird)	(5.0gBLS/bird)	(10.0gBLS/bird)	(15.0gBLS/bird)	
Final Live weight (g/bird)	1488.10[a]	1490.48[a]	1490.48[a]	1438.10[b]	0.12
Plucked weight (g/bird)	1475.00[a]	1325.00[b]	1325.00[b]	1275.00[c]	0.1
Plucked weight (% LW)	88.06[a]	85.51[b]	85.51[b]	85.03[b]	0.01
Breast weight (g/bird)	250.00[a]	225.00[b]	250.00[a]	200.00[b]	0.22
Breast weight (% LW)	14.93[b]	14.56[b]	16.07[a]	13.37[c]	0.14
Dressed weight (g/bird)	1082.50[a]	1000.00[a]	1085.00[a]	952.50[b]	1.2
Dressed weight (% LW)	64.62	64.56	70	63.55	0.02
Thigh weight (g/bird)	147.50[a]	150.00[a]	130.00[b]	125.00[b]	0.13
Thigh weight (% LW)	8.82	9.68	8.37	8.43	0.02
Drum stick weight (g/bird)	150.00[a]	150.00[a]	150.00[a]	110.00[b]	0.15
Drum stick weight (% LW)	8.96	9.69	9.69	7.37	0.01
Head weight (g/bird	60	50	50	65	0.04
Head weight (% LW)	3.58	3.23	2.23	4.36	0.03
Shanks weight (g/bird)	50.00[b]	50.00[b]	67.50[a]	67.50[a]	0.25
Shanks weight (% LW)	2.99	3.23	3.23	4.36	0.01
Neck weight (g/bird)	50	55	45	50	0.03
Neck weight (% LW)	2.98	3.54	2.9	3.34	0.01
Wing weight (g/bird)	150.00[a]	125.00[b]	105.00[b]	145.00[a]	0.14
Wing weight (% LW)	8.97[b]	8.04[b]	6.27[c]	9.68[a]	0.01
Egg follicle (g/bird)	29.29[a]	30.05[a]	2.03[c]	9.25[b]	0.02

abcd: Mean with different superscripts on the same horizontal row differ significantly ($p<0.05$). LW = Live Weight.

The live, plucked, dressed and egg follicle weights decreased progressively and significantly ($p<0.05$) with increased in the quantity of BLS fed to the birds. Liver weight increased significantly ($p<0.05$) with increased in the quantity of BLS offered to the GP (Table 5).

Table 5. Some organs characteristics of growing pullets fed basil leaf supplement

	Treatments				
	A	B	C	D	SEM
Parameters	0.0 gBLS	5.0gBLS/	10.0gBLS/	15.ogBLS/	
Head weight (g/bird)	5.97	6.5	6.01	5.9	0.2
Head weight (% LW)	0.36	0.42	0.39	0.39	0. 01
Liver weight (g/bird)	24.38[c]	26.01[a]	25.01[b]	27.42[a]	0.2
Liver weight (% LW)	1.47[c]	1.68[b]	1.61[b]	1.83[a]	0.1
Spleen weight (g/bird)	2.29	1.64	2.5	2.43	0.11
Spleen weight (% LW)	0.15	0.11	0.15	0.16	1.1
Lungs weight (g/bird)	8.6	7.17	6.54	7.04	0.03
Lungs weight (% LW)	0.51	0.46	0.42	0.47	0.23

abcd: Mean with different superscripts on the same horizontal row differ significantly ($p<0.05$).

4. Discussion

The diet meets the recommended nutrients requirement for the growing pullets (GP) and it is in line with the standards of NRC (1994) and Applegate and Angel (2014). The CP for BLS reported in the present study is higher than the report of Mensah et al. (2008) who reported CP of the leaves of OG to be 4.7%, while the CF was

10.8%, unlike Edeoga et al. (2006) whose reports were 9.19-17.94 for CP, 5.74-6.88% for ash and 18.52% for CF and DM of 91.11-93.00%. The variation in CP and CF in the studies could be due to the ages of the plants and season, as the present study was carried out during the dry season. Mensah *et al.* (2008) reported 1.22, 2.34 and 0.03% for Ca, Potassium and Fe, respectively for the leaves of OG. The reports of the present study with reference to the concentrations of magnesium (Mg) (0.50%) and Fe (282.05 mg kg^{1}) in the leaves of OG is in one accord with the reports of Mensah et el. (2008) who reported Mg(0.43%) and Fe (300 mg kg^{1}) in the leaves. However, the concentrations of Ca, P, Na and K are not in consonant with the submissions of the aforementioned authors. The values of Mg (0.72%), P (0.62%), Na (0.68%) and tannin (0.600%) reported by Edeoga et al. (2006) were higher than the present study. The significant differences ($p<0.05$) observed in the performance indices studied could be attributed to the nutritive value of BLS which is very rich in minerals, as the birds were fed the same growers diet. The FLW reported here is at variance with the reports of Nworgu et al. (2012) (1400-1690g/bird). Similar scenario was observed in terms of daily weight gain (DWG), as Nworgu et al. (2012) reported DWG of (9.00 -14.48g/bird/days) against 7.95-9.35g/bird/day in the present study. The FCR (12.74 to 13.82) reported here is higher than the reports of Nworgu et al. (2012) (6.84 – 11.26). Nweze and Ekwe (2012) highlighted that broilers fed dietary supplement of *Ocimum gratissimum* extract had higher final body weight and weight gain. This report is not in agreement with the present study. The FI recorded in the present study was least on birds served 15gBLS/bird (6152.65), unlike the control (6671.55gBLS/bird). The nature of the BLS could probably confer some astringency or anti-nutritional factors on the birds and thereby reduce their palatability and consumption. Similar observations were made by Nworgu et al. (2012) when growing pullets were fed diets containing graded levels of wilted water leaves (WWLM). Reduction in feed intake for the GP served 15gBLS could be attributed to the anti-nutritional factors that were present in the BLS. Edeoga et al. (2006) reported that OG leaves contained alkaloids, tannin, phenols, saponin and flavonoids, among others. The daily FI in this study partially corroborates with the submission of Nworgu et al. (2012) (99.20-101.31g/bird) and corroborates with the findings of Anaeto and Adighibe (2011) (101.20 – 109.20g/bird), but lower than Sogunle et al. (2012) (113.03 – 135.63g/bird). The variation in the FLW, WG, FCR and FI could be attributed to the duration of the experiment, feed quality, age of the birds, breeds, type of ingredients used and the season of the year the experiment was carried out and the level of management practices adopted. The lower FLW and WG recorded on the GP fed 15gBLS/bird in 3 days interval could be attributed to the high fibre content of the BLS. This is likely the reason the BLS is recommended for the diabetic patients and those who want to shade weight. The CFPKLWG (₦730.78-N792.92 kg^{1}) is 2.77 to 3.0 times more than the revelation of Nworgu and Fasogbon (2007) (N243.65-N285.5 g kg^{1}) and 1.93 times more than the submission of Nworgu et al. (2012). This indicates the higher cost of feed, high inflation and high cost of animal products presently. The highest number of eggs laid for the birds served BLS could also be due to hypolipideamic effect of BLS on level of cholesterol in the birds thereby improved the egg formation. The 100% survivability recorded on GP fed BLS based diet indicated that the BLS was not toxic and dangerous to the birds within the experimental period based on the quantities used. The GP fed 10-15BLS had the least weight of egg follicle indicating anti-egg follicle formation effects of BLS at that level of feeding. Obianime et al. (2010) reported that male mice orally administered 11-88 mg kg^{1} OG aqueous leaves extract daily for 1, 2 and 4 weeks had reduced sperm count and decreased motility, while the percentage of abnormal sperm cells, sperm debris and primordial cells were increased dose and time dependently. The authors concluded that OG had anti-fertility effects in the male mouse.

In Nigeria, some patients take basil leaf extract as curative therapy for some diseases (diabetes mellibus, diarrhea, pneumonia, liver problems and piles). The differences observed in the live weight explain largely the variations in plucked and dressed weights and some cut parts. The dressed weight (63.55-70.00%) live weight in the present study collaborates with the findings of Alaka (2015) (62.07-65.00%LW). Bogosavljevic-Boskovic *et al.* (2012) reported that rearing systems influence carcass qualities. Fouad and El-Senousey (2014) noted that increasing dietary protein content improved weight gain, carcass quality and reduced fat deposition in broilers. Breast weight (%LW) (13.37-16.07) is not in harmony with the submission of Berri (2000) (21.00-27.06%LW) due to the fact that the authors reports centered on broilers. The hypertrophy nature of the livers of the birds served BLS could also be attributed to extra works of additional bulk of BLS metabolism executed by the livers. Similar observation was made by Egbeyale et al. (2012) who reported 2.17 – 2.57(% live weight) for liver and lungs (0.54 – 0.57%LW). The liver weight (%LW) in the present study (1.47-1.83) is lower to the revelation of Egbeyale et al. (2012).

5. Conclusion

The BLS is a good source of mineral and fibre supplement for GP. The most available minerals in BLS are calcium, phosphorus and iron, but low in tannin, oxalate and phytate. Supplementing the GP diet with

5-15gBLS/bird did not result to mortality of the birds. The GP served 15gBLS resulted to lower final live weight, weight gain, plucked weight and egg follicle weight and increased in liver weight. For improved performance in terms of WG and number of eggs laid GP should be served dietary concentration of 5-15gBLS/ bird and later should be reduced to 5g/bird at 3 days interval when the GP had come up to 15-20% in lay, in order to minimize further loss in weight and reduction in egg follicle formation. The BLS can be used as a weight reduction additive.

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