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Effects of Single Leafy Spices on Growth and Carcass Characteristics of Broilers

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Target Audience: Poultry Farmers, Researchers, Feed Producers, Consumers

Abstract

This study attempted to evaluate the effects of dietary spice supplementation on the growth performance, carcass characteristics and organ weights of broilers. One hundred and sixty (160) two-week old broilers of Anak 2000 commercial strain were randomly assigned to four groups with four replicates per treatment. The dietary treatments consisted of a control (basal diet), basal diet + 10g basil leaf meal-BLM/kg diet, basal diet + 10g Heinsia leaf meal-HLM/kg diet and basal diet + 10g Piper leaf meal-PLM/kg diet. Fresh feed and water were offered daily ad libitum. Body weight gain, feed intake and feed efficiency were determined weekly. At the end of the study (42 days), carcass weight, internal organ weight and breast meat composition were determined. Growth performances were not different between dietary treatments. However, a lower mortality (2.50%) was observed in broilers fed BLM and PLM diets than in the control (5.00%). Supplementation with piper leaf meal resulted in better feed efficiency (3.32), compared to the control (3.40) and other treatment groups (3.51; 3.74). Also, birds on leafy-spice diets generally had higher head (64-80 g), wings (211-225 g) and windpipe (2.16-2.78) weights compared to the control group. Carcass composition improved with reduced crude fat (2.88-5.00%) in birds on spice meal supplementation. From the results, it appears that considerable growth promoting effect may be obtained when broiler ration is supplemented with up to 10 g leafy spice/kg diet.

Keywords: Growth Enhancer, Feed Supplements, Leafy spices, Performance, Broilers

Description of Problem

Concern about food safety is rising as consumer awareness increases around the world. As consumers become better informed, they are now more conscious of the potential hazard to public health that could result from the consumption of animal products from antibiotic resistant livestock (1). To some extent this is now a key factor to the continuity and profitability of the livestock industry (2). Indicted are a wide range of (synthetic) antibiotics against which certain bacterial pathogens have grown resistant (3, 4, 5, 6). Consequent is the ban in many countries (especially of the European

Union) on the use of all types of synthetic antibiotics as growth promoters in livestock production (7, 8, 9).

Presently, commercial additives of plant origin have been proposed and are being developed as possible replacements for synthetic antibiotics (10, 11, 12, 13). Of these, significant attention has been placed on herbs, spices and their products as either single compounds or mixtures (14, 15, 16). Reported literature has suggested that plant materials enhance the secretion of endogenous digestive enzymes, and activate the immune response and antioxidant activities (17). Supplementing poultry diet with plant materials stimulates and increases feed intake, enhances weight gain, improves carcass quality and decreases mortality (18). Lee *et al.* (12) also reported increased liver mass when broilers ingested thyme oil diets. Some vegetable species, especially of the *families Lamiaceae, Piperaceae, Rubiaceae, Alliaceae* and *Solanoceae* haven shown strong antimicrobial, antibacterial (19), anti-stress (20) and growth promoting (17,18) activities.

This study was designed to evaluate the effects of single tropical leaf meals (*Basil* leaf meal-BLM, *Heinsia* leaf meal-HLM and *Piper* leaf meal-PLM) on the growth performance, carcass weight, carcass yield, abdominal fat weight, intestinal organ weight and carcass composition of broilers.

Materials and Methods

Location:

One hundred and sixty (160), two weeks-old broilers of the Anak 2000 commercial strain were randomly assigned to one of four treatments (with four replicates each) in a completely randomized design. The experiment was conducted in Calabar (Longitudes 8.0^{o} – 8.3^{o} and Latitudes 4.4^{o} – 5.2^{o}) (21) South Eastern Nigeria, between March and May, 2007 in an open-sided broiler house under the deep litter system.

Preparation of leaf spices:

Three tropical leafy spices, *Ocimum gratissimum, Heinsia crinata* and *Piper guincense* were obtained from Adiabo village in Odukpani Local Government Area of Cross River State, Nigeria. The leaves collected were sorted, shroud from stalk, sun-dried for three days after they were milled into powder form to obtain *Basil* leaf meal (BLM), *Heinsia* leaf meal (HLM) and *Piper* leaf meal (PLM), respectively. To assess their potentials as growth promoters, 10g/kg of each leaf meal was supplemented into the basal diet as recommended by Angulo *et al.* (22).

***Experimental Diets*:**

The composition of the basal diet is given in Table 1. The antibiotic-free diet was prepared from local feed ingredients and was formulated to meet the requirements of the National Research Council (23) for broilers.

The four dietary treatments consisted of a basal diet (basal diet), basal diet + 10g BLM/kg, basal diet + 10g HLM/kg and basal diet + 10g PLM/kg. Throughout the 42 days experiment, fresh feed and water were provided *ad libitum* at 0900h and 1600h daily. No vaccines or drugs were administered throughout the experiment.

Table 1. Composition of basal diet (%).

Ingredient (%)	**0 – 42 days**
Yellow maize	50.20
Soybean meal	23.30
Crayfish dust	14.00
Palm kernel cake	3.00
Wheat offal	6.00
Bone meal	2.00
Vitamin premix[a]	0.50
Sodium chloride	0.50
Lysine	0.30
Methionine	0.20
Total	**100**
Calculated Analysis (%)	
Crude protein, %	23.00
ME, kcal/kg	2843.00
Calcium	0.97
Phosphorus	0.48
Lysine	1.20
Methionine	0.05

[a]Supplied the following per kg of diet: Vitamin A 75,000iu; Vitamin D_3 15,000iu; Vitamin E 75iu; Vitamin K_3 12.5mg; Vitamin B_1 5mg;Vitamin B_2 50mg; Vitamin B_{12} 20mg; Folic Acid 10mg; Biotin 0.5mg; Niacin 350mg; BHT 625mg; Calcium –D- Pantotenic Acid 100mg

***Data Collection*:**
Feed consumption per pen was measured daily, while body weight and weight gain were measured weekly. Feed consumption per pen and weight gain per pen was used to calculate the weekly feed efficiency. Mortality was recorded as it occurred and percentage mortality was determined at the end of the study.

***Carcass Analysis*:**
At day 42, three (3) birds per replicate/pen (that is twelve birds per treatment) were slaughtered by cervical dislocation followed by exsanguinations according to the Guidelines for the Care and Use of Laboratory Animals (24). The carcasses were plucked and the heads, necks and legs were removed. Eviscerated weights were measured and internal organs including the liver, kidney, gizzard, abdominal fat and crop were carefully excised and weighed individually. The length, width and weight of the intestines were measured.

Meat samples from the back, breast, thigh and wing muscle were separated and individually weighed according to the WPSA reference cutting method (25). The carcass yields were calculated by dividing the eviscerated weights by the respective live weights. Prior to chemical analysis, samples of breast meat were collected from six (6) birds per treatment and stored in a refrigerator at 4^oC. They were thereafter thawed, homogenized and analyzed for the ash, fat, moisture and protein according to the AOAC (26) techniques.

Data Analysis:
Data collected were subjected to the one-way analysis of variance (ANOVA) using the SPSS statistical package. Where significant, treatment means were separated using the Duncan's test for multiple comparison at ά = 0.05 and 0.01 levels (27).

Results and Discussion
The effects of dietary supplementation of three leafy spices on broiler performance are presented in Table 2. Average daily gain and feed efficiency did not differ (P > 0.05) between birds on the control and those fed leafy spice diets. Compared to the control, significant effects of leafy spices were observed on the final body weight and average feed intake of birds on spiced-diets. Broilers fed PLM diet had higher (P > 0.05) weight gain with better feed efficiency than birds on other leafy spices and the control group. Feed intake decreased (P < 0.05) in birds fed diets supplemented with leafy spices compared to the control. Percentage mortality also reduced (P < 0.05) in broilers fed BLM and PLM diet than those fed the control and HLM diets.

Table 2. Effect of spice supplements on performance of broilers

Parameter	Control	BLM	HLM	PLM	S.E.M.	P
Initial body weight (g)	282.00	280.00	280.40	282.00	2.01	NS
Final body weight (g)	2258.94[d]	2262.4[c]	2292.22[b]	2421.48[a]	8.45	*
Average daily gain (g/d)	47.07	47.20	47.90	50.94	2.30	NS
Average feed intake (g/d)	124.32[a]	123.99[a]	122.22[a]	120.79[b]	1.32	*
Feed efficiency (FI/WG)	3.40	3.51	3.74	3.32	0.49	NS
Percentage mortality (%)	5.00[b]	2.50[a]	5.00[b]	2.50[a]	0.15	*

[a, b, c] Means within row with different superscripts differ at P < 0.05* NS – Not significant (P > 0.05) difference between means within row. S.E.M. – Pooled standard error of mean.

The measures for carcass yield, carcass weight, carcass cut, head weight, neck weight and feet weight (various carcass weights) as percentages of live weight are shown in Table 3. Relative head weight, breast weight, wing weight and percentage carcass yield were significantly (P < 0.05) different between treatments. Birds fed the PLM diet had significantly (P < 0.05) higher percentage carcass yield and breast weight compared to the control. The lowest carcass weights were recorded in birds on HLM diet. Results revealed that inclusion of BLM in broiler diet increased the head and wing weights. The thigh weight was 1.37%

heavier in birds on PLM diet than those on the control.

Results on relative organ weights (% live weight) and intestinal size are presented in Table 4. Except for windpipe weight, no significant (P > 0.05) differences were observed in organ weights between dietary treatments. The addition of PLM to the basal diet slightly (P > 0.05) increased proventicular, liver, crop and intestinal weights of the birds while; the heart weight, kidney weight, abdominal fat pad and intestinal diameter were lower, compared to those on the control diet. Birds on BLM diet had higher gizzard and lung weight compared to those on the control and other spiced-diets

Table 3. Effect of dietary spice supplementation (10g/kg) on the carcass characteristics of broilers.

	C	BLM	HLM	PLM	SEM	P
Pre slaughter weight (g)	2258.94^{d}	2262.4^{c}	2292.22^{b}	2421.48^{a}	8.45	*
Slaughter weight (g)	1865.0^{b}	1835.0^{c}	1805.0^{d}	1895.0^{a}	6.25	*
Dressed weight (g)	1490.90^{b}	1467.94^{c}	1463.54^{c}	1591.37^{a}	5.06	*
Feet (% live weight)	5.00^{a}	5.89^{a}	4.38^{b}	5.53^{a}	1.05	*
Head (% live weight)	2.52^{b}	3.49^{a}	2.64^{b}	3.40^{a}	1.08	NS
Neck(% live weight)	6.20	4.76	4.96	5.44	1.52	NS
Carcass Cut						
Back (% live weight)	14.17^{a}	13.96^{a}	12.18^{b}	14.14^{a}	0.45	*
Breast (% live weight)	20.81^{a}	19.63^{b}	18.58^{c}	22.10^{a}	0.25	*
Thighs (% live weight)	21.47^{b}	21.29^{b}	19.00^{c}	22.85^{a}	0.72	*
Wings (% live weight)	8.81^{ab}	9.82^{a}	8.22^{b}	9.33^{a}	0.68	*
Hot carcass yield (%)	66.0^{b}	64.04^{c}	60.44^{d}	70.34^{a}	0.20	*

$^{a, b, c}$ Means within rows with different superscripts differed at P < 0.05(*)
NS – Not significant S.E.M. – Pooled standard error of mean

The chemical composition of broiler breast meat was significantly (P < 0.01) influenced by dietary treatments (Table 5). Supplementing the basal diet with BLM and HLM meals, respectively significantly (P < 0.01) increased the protein content of the breast muscles. The meat of birds on PLM diet had significantly higher nitrogen free extract but significantly lower fat content, compared to birds on other treatments; which also differed amongst themselves. Supplementing the basal diet with spicy-leaf meals at 10g/kg had significant (P < 0.05) growth promoting effect on the final body weight and feed intake of broilers, but no effect (P > 0.05) on feed efficiency and rate of weight gain in broilers. Among the dietary groups, the PLM showed the best feed efficiency.

This was consistent with the reports by (9) and (29) who reported significant improvement in the growth performance of quails fed diets supplemented with thyme essential oil. It however, contradicted some reports in the literature that no significant improvements were observed in broilers fed diets supplemented with plant materials – inclusive of extracts (13, 28).

Table 4. Effect of the dietary inclusion of spices (10g/kg) on relative organ weight and abdominal weights in broilers.

Relative organ weight (% Live weight)	C	BLM	HLM	PLM	SEM	P
Heart	0.34	0.30	0.28	0.29	0.07	NS
Liver	1.60	1.78	1.56	1.89	0.18	*
Kidney	0.07	0.08	0.08	0.07	0.01	NS
Gizzard	2.64	2.83	2.40	2.62	0.46	NS
Proventriculus	0.34	0.34	0.33	0.38	0.06	NS
Lungs	0.35	0.42	0.32	0.39	0.11	NS
Crop	0.10	0.11	0.12	0.15	0.07	NS
Abdominal fat pad	0.20	0.16	0.20	0.22	0.07	NS
Wind pipe	1.17	1.28	1.19	1.21	0.15	NS
Esophagus	0.08^{c}	0.09^{b}	0.12^{a}	0.06^{d}	0.01	*
Intestine	0.11	0.10	0.10	0.11	0.04	NS
Intestinal diameter	101.62	98.02	104.94	106.60	9.27	NS
Intestinal length (cm)	200.34	185.20	197.00	185.48	15.25	NS
Intestinal width (cm)	1.34	1.32	1.34	1.32	0.03	NS

[a,b,c,d] Means within rows with different superscripts differed at $P < 0.05$ (*) NS – Not significant S.E.M. – Pooled standard error of mean

Table 5. Effect of spice supplementation (10g/kg) on the chemical composition of the breast meat of broilers.

Composition	C	BLM	HLM	PLM	S.E.M.	P
Dry matter (%)	24.31^{d}	28.48^{a}	25.50^{c}	26.32^{b}	0.48	**
Moisture (%)	75.69^{a}	71.52^{c}	74.50^{b}	73.68^{b}	0.48	**
Crude Protein (%)	43.53^{c}	48.50^{a}	48.26^{b}	43.42^{c}	0.74	**
Crude fat (%)	9.16^{a}	5.00^{b}	4.43^{b}	2.88^{c}	0.71	**
Ash (%)	5.15^{b}	4.80^{c}	6.71^{a}	5.15^{b}	0.25	**
Nitrogen free extract (%)	42.16^{b}	41.70^{b}	40.60^{c}	48.60^{a}	0.95	**

[a, b, c] Means within rows with different superscripts differed at $P < 0.01$ (**) NS – Not significant S.E.M. – Pooled standard error of mean

Variations in results could be attributed to the type and form of spice used, the age and species of birds as well as the level of supplementation.

The slight growth promoting effect on broiler performance could have been either the result of the favorable conditions under which the experiment was conducted or that the level of supplementation may have been inadequate to stimulate significant improvement. Our findings revealed that at 10g PLM/kg diet supplementation, significant increases were observed on hot carcass yield and breast weight compared to the control. Thus indicating the better feed utilization recorded for the PLM group. However, carcass weight was unaffected. This agreed with reports by Alp *et al.* (30) when organic acid mixtures were added to broiler diet.

On internal organ weight, the PLM group had the highest liver, proventriculus, and crop weight; suggesting that decreased digestive activities occurred as earlier reported by Debersac *et al.* (31). The reduced abdominal fat weight also suggested increase energy expenditure and intestinal length might suggest that spice meals may have positive effect on the intestinal microflora. Results further revealed that spicy-leaf meal supplementation significantly improved the carcass quality of broiler breast meat in terms of crude protein and fat contents. These data are consistent with the findings of Bolukbasi *et al.* (6) that leaf meal supplementation improved the growth performance and carcass quality of broilers.

Conclusion

It could be concluded that;

1. Slight improvement was observed in the growth performance of broilers fed spicy-leaf diets.
2. Supplementation with either *Piper* leaf meal-PLM or *Basil* leaf meal-BLM significantly improved the carcass composition of the breast meat.
3. The growth promoting ability of the three leafy spices (*Basil* leaf meal -BLM, *Heinsia* leaf meal - HLM and *Piper* leaf meal-PLM) might exceed 10g /kg diet.

Recommendation

This study justifies further research to determine the optimal dietary inclusion level of spicy-leaf meals to achieve optimal growth and digestion in broilers.

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