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EFFECT OF GROUND GINGER AND GARLIC ON THE GROWTH PERFORMANCE, CARCASS QUALITY AND ECONOMICS OF PRODUCTION OF BROILER CHICKENS

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ABSTRACT
This study evaluated the effect of ground ginger and garlic on the growth performance, carcass quality and economics of production of broiler chickens. 100 broiler chickens were randomly allotted to five treatments identified as T_1, T_2, T_3, T_4 and T_5. Each treatment was replicated four times with five birds per replicate. Birds on T_1 served as control, those on T_2 and T_3 received ground ginger and garlic in powder form at 14g/kg of the diet respectively, while those on T_4 and T_5 were given ground ginger and garlic in water-based infusion at 50ml/liter of drinking water respectively. Significant variations ($p<0.05$) existed between the control and other treatments in mean final body weight, daily body weight gain, daily feed intake and feed conversion ratio (FBW, WBWG, DFI and FCR respectively). The birds fed with garlic had better FCR (2.17) than those fed ginger (2.42) or control (2.53). The birds fed the powder form showed better performance ($p<0.05$) in FBW, WBWG, DFI and FCR of 2493.75g, 340.00g, 105.96g and 2.19 respectively than those fed the water-based infusion. The usage of the test ingredients had a significant effect ($p<0.05$) on abdominal fat weight and dressing percentage. A better performance was observed when they were given in powder form. T_3 had the highest revenue and net return, and also gave the least cost-benefit ratio. The inclusion of the test ingredients in the diets of broiler chicks boosted the traits monitored without any adverse effect and is recommended in the diets of broiler chicks.

KEYWORDS: ginger, garlic, growth performance, carcass quality, economics of production

INTRODUCTION

Antimicrobial compounds produced by microorganisms have been used in animal rations as growth promoters for many years (Barragry and Powers, 1994). Antibiotics have been used widely to prevent infections and poultry diseases and for the improvement of meat and egg production. However, use of antibiotics is restricted due to drug resistance in bacteria, drug residue in carcass and also alteration of natural gut micro flora (Botsoglou *et al.*, 2002). Recently many countries tend to minimize or prohibit the use of antibiotics because of their deleterious side effects on both animals and human. Consequently, the of use of natural promoters such as probiotics, prebiotics, symbiotics, enzymes, toxic binders, organic acids, oligosaccharides, phytogenics, and other feed additives, to enhance the growth and performance of broiler chickens have been advocated (Borazjanizadeh *et al.*, 2011). Garlic and ginger as natural growth promoters can be potential alternatives for common artificial growth promoters like antibiotics (Demir *et al.*, 2003). Ginger is the rhizome of the plant *Zingiber officinale*, consumed as a delicacy, medicine, or spice. Preliminary research indicates that nine compounds found in ginger may bind to serotonin receptors which may influence gastrointestinal function (Botsoglou *et al.*, 2002). Research conducted *in- vitro* tests show that ginger extract might control the quantity of free radicals and the peroxidation of lipids (Al-Amin *et al.*, 2006). The characteristic odor and flavor of ginger is caused by a mixture of zingerone, shagaols and gingerols, volatile oils that compose one to three percent of the weight of fresh ginger. Rivlin (2001) reported that in laboratory animals, gingerols increase the motility of the gastrointestinal tract and have analgesic, sedative, antipyretic and antibacterial properties. Garlic *(Allium sativum)* has been used as a spice and a native medicine for many years. It has been indicated to possess antibacterial, antifungal, antiparasitic, antiviral, antioxidant, anti-cholesteremic, anticancerous and vasodilator characteristics (Khan *et al.*, 2007; Hanieh *et al.*, 2010). The key active ingredient in garlic is the plant chemical, allicin, which rapidly decompose to several volatile organosulphur compounds with bioactivities (Chang and Cheong, 2008). Ginger and garlic supplements in broiler chicken diets have been recognized for their strong stimulating effect on the immune and digestive systems in birds (Horton *et al.*, 1991; Gardzielewska *et al.*, 2003). The objective of the present study was to evaluate the effect of different feeding methods of ginger and garlic on the growth performance, carcass quality and economics of production of broiler chickens.

MATERIALS & METHODS

The study was carried out at the Poultry Unit of the Teaching, and Research Farm of the Department of Animal Science, Ebonyi State University Abakaliki, which lies approximately on latitude 8^0 30' E and 9^0 40' and longitude 5^0 40' and 6^0 45'(Nwakpu, 2005). One hundred day-old Obasanjo Marshal Broiler chickens used for the

study were purchased from Obasanjo Farms Nigeria Limited, Ota in Ogun State. The chicks were kept for seven days to acclimatize; within this period, they were fed commercial broiler starter diet only and given plain drinking water. On the 8th day, the 100 chicks were randomly allotted to five treatments in a completely randomly design (CRD) with 20 chicks/treatment. Each treatment was replicated four times with 5 chicks per replicate. The birds were housed in a wooden three-tier battery cage, each replicate cell measuring 30 x 44 x 21 inches. The treatments were identified as T_1, T_2, T_3, T_4, and T_5 such that birds on T_1 (control diet) received basal diet and water without ginger or garlic, those on T_2 were given ginger powder mixed in the feed at 14g/kg of basal diet, those on T_3 were given garlic powder mixed in the feed at 14g/kg of basal diet, those on T_4 were given ginger infusion at 50ml/liter of water, and those on T_5 were given garlic infusion only at 50ml/liter of water. The experiment lasted for 49 days. The basal diet consisted of commercial starter diet (22% CP, 2900kcal/kg ME) fed for the first 28days and finisher diet fed from the 28 to 49day (18%CP, 2900kca/kg ME).

Preparation of test ingredients

The ginger and garlic used were purchased fresh from Abakaliki market. Their rinds and husks were peeled off using knife. The peeled ginger and garlic were washed and sun dried, and later ground to fine powder. 14g/kg feed of the garlic and ginger powder was added to the feed daily as an additive. The infusion was prepared by adding one liter of boiled hot water to 14g of ground ginger and garlic in separate non-metallic containers. The mixtures were allowed to cool at room temperature overnight. The next morning, the infusion was filtered using a filter paper, and then administered via drinking water at the dose rate of 50ml/liter. Garlic and ginger infusion was made available to the birds for 12hours/day. Fresh infusion was prepared on daily basis.

Data collection

Data were collected on growth performance traits (such as daily feed intake, daily body weight gain, final body weight and feed conversion ratio). On the last day of study, three birds from each replicate were live weighed and slaughtered. The head, shank, and all internal visceral organs, including abdominal fat were removed and then the carcass was weighed. The carcass weight was expressed in terms of dressing percentage as follows: Dressing percentage = (Carcass weight/Live weight) x 100. The abdominal fat was also trimmed out and weighed. The following parameters were evaluated to estimate the economics of production - Feed cost ₦/kg feed consumed/bird/treatment, feed cost ₦/kg weight gain/bird/treatment, total revenue generated/bird, net returns (₦)/bird and cost-benefit ratio.

Data analysis

The data collected on growth performance and carcass quality traits were statistically analyzed by analysis of variance using Repeated Measures in General Linear Model in the statistical package SPSS (2009). Significant means were separated using Fishers Least Significant Difference (F-LSD).

The following statistical model was applied:

$X_{ijk} = \mu + H_i + M_j + HM_{ij} + E_{ijk}$.

Where;

X_{ij} = any observation made in the experiment,

μ = the population means,

H_i = effect of type of herb (I = ginger, garlic),

M_j = effect of method of feeding (j = infusion, feed),

HM_{ij} =effect of herb and feeding method,

E_{ijk} = experimental error.

The data recorded for the economics of production were evaluated using a cost-benefit analysis. The cost of production included the cost of feeding, procurement of birds, labor, medication, and other exigencies.

RESULTS

The result of the effect of herb on the growth performance and carcass quality of birds is shown in Table 1. Inclusion of garlic and ginger had strong effect on the growth performance traits monitored. Though there was no significant difference ($p>0.05$) in the initial body weight of the birds, feeding the test ingredients significantly ($p< 0.05$) affected the final body weight of the birds. Birds fed garlic weighed heavier than those fed ginger. The least weight was observed in birds fed the control diet. The daily body weight gain of the birds on the test ingredients was better ($p<0.05$) than those on the control diet. Birds on garlic and ginger diet consumed and utilized more feed daily than those on control diet, as indicated by the feed conversion ratio. Birds fed garlic showed a significant ($p<0.05$) increase in dressing percentage. There was no significant ($p> 0.05$) difference between birds fed ginger and those fed garlic in the dressing percentage and abdominal fat. Abdominal fat of the control birds was higher than those of birds fed the test ingredients ($p< 0.05$). Feeding of the test ingredients to the birds in powder form and through water-based infusion significantly ($p< 0.05$) affected all the growth performance traits studied (Table 2). Birds fed the test ingredients in powder form weighed significantly heavier and consumed more feed daily ($p< 0.05$) than those fed through water-based infusion. The result of the feeding method on the carcass quality of birds as shown in table 2 indicates that the dressing percentage was significantly ($p< 0.05$) increased when ginger and garlic were fed in powder form. However, the abdominal fat was greatly reduced than in the control diet, though birds fed the powder form gave a better result than those on infusion ($p< 0.05$). Table 3 presents the result of the interaction of herb and feeding method on the performance traits of the birds. There were significant variations ($p<0.05$) in the final body weight of the birds across treatment combinations. The daily body weight gain, daily feed intake, and feed conversion ratio of birds on T_3 had a significant ($p< 0.05$) increase than the other treatments. There was no significant ($p>0.05$) difference in daily body weight gain, and feed conversion ratio of T_2 and T_5, and between T_1 and T_4. It was observed from the result of the interaction effect of the herb type and feeding method that T_3 showed a better performance ($p<0.05$) in terms of the dressing percentage than other treatments. Result of the economics of production of

feeding the experimental diets is shown in Table 4. T_3 recorded the highest feed intake, total cost of feed, total cost of production, total body weight, and total body weight gain. T_4 recorded the highest feed cost/kg weight gain. The highest revenue and net return was obtained from birds on T_3.

TABLE 1. Performance Traits of Birds Fed Different Herbs

Traits \ Herb	Control	Ginger	Garlic	SEM
IBW (gm)	120.00	125.00	120.00	1.12
FBW(gm)	1950.00^{c}	2168.75^{b}	2475.00^{a}	6.25
WBWG(gm)	261.43^{c}	292.86^{b}	336.45^{a}	0.58
DFI(gm)	94.95^{b}	101.20^{a}	104.05^{a}	0.16
FCR	2.53^{a}	2.42^{b}	2.17^{c}	0.01
Dressing %	69.18^{b}	81.72^{a}	81.95^{a}	0.86
Abdominal fat (gm)	52.68^{a}	21.51^{b}	17.89^{b}	1.60

^{abc}Means on the same row followed by different superscripts are significantly different ($p<0.05$)

TABLE 2. Performance of birds fed dietary treatments in different forms

TRAITS \ FEEDING METHOD	CONTROL	POWDER	INFUSION	SEM
IBW(g)	120.00	120.00	125.00	1.12
FBW(g)	1950.00^{c}	2493.75^{a}	2150.00^{b}	4.17
WBWG(g)	261.43^{b}	340.00^{a}	289.29^{b}	0.00
DFI(g)	94.95^{b}	105.96^{a}	99.30^{b}	0.09
FCR	2.53^{a}	2.19^{c}	2.40^{b}	0.06
Carcass weight	1351.5^{c}	2206.25^{a}	1627.13^{b}	9.25
Dressing percentage	69.18^{c}	88.08^{a}	75.585^{b}	0.43
Abdominal fat(g)	52.68^{a}	26.37^{b}	13.05^{c}	0.83

^{abc}Means on the same row followed by different superscripts are significantly different ($p<0.05$)

TABLE 3. Interaction of herb x feeding method on the performance traits studied

TRAITS \ H X F	T1	T2	T3	T4	T5	SEM
IBW	120.00	120.00	120.00	130.00	120.00	1.12
FBW(g)	1950.00^{e}	2287.5^{b}	2700.00^{a}	2050.00^{d}	2250.00^{c}	16.00
WBWG(g)	261.43^{c}	311.43^{b}	368.57^{a}	274.29^{c}	304.29^{b}	0.58
DFI(g)	94.95^{c}	104.06^{a}	107.85^{a}	98.35^{b}	100.24^{b}	0.21
FCR	2.53^{a}	2.33^{b}	2.05^{c}	2.50^{a}	2.30^{b}	0.13
Carcass weight(g)	1351.50^{e}	2025.00^{b}	2387.50^{a}	1554.25^{d}	1700.00^{c}	32.88
Dressing percentage	69.18^{c}	87.83^{a}	88.33^{a}	75.61^{b}	75.56^{b}	1.18
Abdominal fat(g)	52.68^{a}	30.23^{b}	22.50^{b}	12.80^{c}	13.30^{c}	4.17

^{abc}Means on the same row followed by different superscripts are significantly different ($p<0.05$)

LEGEND
IBW – Initial Body Weight; FBW – Final Body Weight; WBWG – Daily Body Weight Gain; DFI – Daily Feed Intake
FCR – Feed Conversion Ratio

TABLE 4. Economic Analysis of Production[ab]

PARAMETERS	T1	T2	T3	T4	T5
Total feed consumed (g)/bird	4652.5	5092.25	5281.5	4809.25	4901.5
Total cost of feed (₦)/bird	511.78	560.15	580.97	529.02	539.17
Total cost (₦)/g feed consumed	0.591	0.540	0.521	0.572	0.561
Total cost of production (₦)/bird	1120.35	1168.72	1189.54	1137.59	1147.74
Final body weight (g)/bird	1950	2287.50	2700	2050	2250
Total body weight gain (g)/bird	1987.50	2180.00	2567.50	1920.00	1972.50
Feed cost (₦)/kg weight gain/bird	1.40	1.26	1.07	1.43	1.40
Revenue (₦)/bird	1560.00	1840.00	2160.00	1640.00	1800.00
Net return (₦)/bird	439.66	671.28	970.47	502.41	652.27
Cost - benefit ratio	2.55	1.74	1.23	2.26	1.76

[a]Assuming that purchasing bird, labour and other exigencies' are constant at ₦ 608.57/bird
[b]Revenue based on ₦800/kg live weight/bird

DISCUSSION

The significant increase in daily body weight gain and final body weight of birds fed ginger and garlic confirms the findings of Demir *et al.*, 2003; Ademola *et al.*, 2005; Javendel *et al.*, 2008) who fed herbal plants (ginger and garlic) as growth promoters in broiler diets and observed a pronounced improvement in their body weight gain and feed conversion ratio. These results might be due to the good health status of the birds, which may be caused by the addition of garlic, and might also be due to the chemical composition of garlic (Reuter, 1995). Onibi *et al.* (2009) and Fadlalla *et al.* (2010), however, reported that garlic powder had no significant effect on the body weight gain and feed conversion ratio of birds. Windisch *et al.* (2009) work on the proven effects of phytobiotic feed additives in different poultry species, indicated a reduced feed intake, and improved feed conversion ratio. Pourali *et al.* (2010) suggested that allicin in garlic promotes the performance of the intestinal flora thereby improving digestion and enhancing the utilization of energy, leading to improved growth. Similar, observations were made Onu and Aja (2011), in their study on weaned rabbits, they noted that these herbs may have controlled and limited the growth and colonization of numerous pathogenic and non pathogenic species of bacteria in the gut leading to improved translation of feed to meat. Ramakrishna *et al.* (2003) also suggested that garlic supplementation enhances the activity of pancreatic enzymes and provides an environment for better absorption of nutrients.Feeding the test ingredients in powder and through infusion, recorded a significant difference ($p<0.05$) in the final body weight, and feed conversion ratio which is contrary to Han *et al.* (2008) cited in Al-Moramadhi (2010), who reported a non-significant effect on body weight of birds fed ginger in powder form. Birds fed the test ingredients in powder form had a significant ($p< 0.05$) increase on their daily body weight gain and daily feed intake than those fed the dietary treatment through infusion. This is contrary to the result of Javed *et al.* (2009) who reported that broiler chicks given aqueous extract of ginger showed an improved body weight gain. The present study indicates that the test ingredients significantly ($p<0.05$) influenced the carcass parts of the broilers. Though, contrary to Dieumou *et al.* (2009) and Pourali *et al.* (2010) who reported that carcass parts were not affected by ginger and garlic, it is however in consonance with Raeesi *et al.* (2010) who reported a significant effect on the carcass parts of broilers fed with garlic. Birds on T_3 consumed more feed, followed by birds on T_2, T_5, T_4 and T_1 which is in agreement with the report of Ademola *et al.* (2009) that ginger enhances feed intake in broilers, which in turn affect the final body weight of birds. Birds on T_3 gave the highest revenue and net return followed by birds on T_2, T_5, T_4 and T_1 respectively. T_3 gave the least cost-benefit ratio, implying that it is the best diet from the economic point of view; since reaching the highest body weight or maximum egg production in return for each unit of feed intake is the aim of raising commercial poultry (Raeesi *et al.*, 2010). Based on the results obtained, it can be concluded that the inclusion of the test ingredients – ginger and garlic – in the diets of broilers boosted the traits monitored without any adverse effect. This implies that their use can be recommended to farmers in the place of antibiotics. Nevertheless, the variations between the results of the present study and those obtained by some other researchers could be attributed to differences in the source and composition of garlic and ginger used, preparation process, feed inclusion levels, the overall diet composition and breed/strain of bird used in the study.

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