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# Effect of ginger (*Zingiber officinale*) on the growth performance and nutrient digestibility of finisher broiler chickens in semi-arid zone of Nigeria

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***Target audience:*** *Poultry farmers, Monogastric Nutritionist, Researchers,*

## Abstract

*A study was conducted to investigate the effects of addition of Ginger (Zingiber officinale) as feed additive on growth performance and nutrient digestibility of finisher broiler chickens. One hundred and forty four (144) finisher broiler chickens were individually weighed (325±6g) and randomly assigned to four dietary treatment groups of thirty six (36). Each group was replicated three times with each replicate comprising of 12 birds. The design was a complete randomized and the study lasted for eight weeks (8). The dietary treatment groups had T1 (0%), T2 (2%), T3 (4%) and T4 (6%) levels of ginger as feed additive. Data collected were subjected to analysis of variance (ANOVA) and where significant differences occurred, means were separated using least significant difference (LSD). The results showed no significant (P>0.05) difference for final weight, daily feed intake and daily weight gain among the dietary treatment groups. Feed conversion values however varied significantly (P<0.05) among treatment. It is concluded that ginger can be included in finisher broiler diet as feed additive without detrimental effects on growth performance. However, finisher broilers fed 6% level as additive performed better compared to their counterparts and is therefore recommended.*

***Key words:*** *Broilers, Ginger, Additive, productive performance and digestibility*

## Description of the problem

Poultry meat and eggs are important foods for fulfilling the dietary needs of the ever-growing human population (1). However, in large scale intensive poultry production, birds are exposed to many stressful conditions and diseases that result in serious economic losses (2). This necessitates the use of pharmaceutical products, such as antibiotics, as prophylactic and curatives to ensure rapid growth and health (1). However, uncontrolled use of antibiotics in animals leaves some residues in meat, milk and egg, which could be harmful to humans (3). A study conducted by (4) reported the contamination of gizzard samples with nitrofuran (41%), tetracycline (14%), sulfamids (8%), and chloramphenicol (5%) residues collected from market and poultry farms. With the increase in regulations regarding the use of antibiotic growth promoters and the rise in consumer demand for poultry products from 'Raised Without Antibiotics' or 'No Antibiotics Ever' flocks, the quest for alternative products or approaches has intensified in recent years (5). In the last decade, herbs and phytogenic compounds have attracted a lot of attention for their potential role as alternatives to antibiotic growth promoters in monogastric animals (6).The interest to use the medical plants is mainly due to its safety, healthy for human, less cost of herbs compared with synthetic chemical drugs and

some of them decrease the level of serum lipids and lead to improve immune function in humans and animals (7). Several studies conducted on the use of herbs and spices in broilers as growth promoters have revealed benefits for the health of broilers and function such as antioxidant property (8), antimicrobial activity (9), enhancing digestion by stimulating endogenous enzymes (10), increase production of digestive enzymes, improve utilization of digestive products by enhancing liver function (11) and increase in body weight and best feed conversion ratio (12, 13). The main important compounds in ginger are gingerol, gingeriol and gingerdione which have the ability to stimulate digestive enzymes, attack the microbial activity and having anti oxidative activity (14) when used in broiler diets. Ginger, one of such comparable natural alternatives, is a perennial herb belonging to the family Zingiberaceae. Ginger is rich in beneficial bioactive compounds and essential oils (15). Study conducted by (16) on the usage of ginger as an alternative for antibacterial growth promoting substances revealed that ginger is advantageous for the greater productiveness of poultry, improved appetite and palatability of feed, nutrient absorption and facilitates gastric enzymes flow. The main important compounds in ginger are gingerol, gingerdiol and gingerdione which have the ability to stimulate digestive enzyme, affect the microbial activity and anti-oxidative activity (17). Ginger contains volatile oils like borneol, camphene, citral, eucalyptol, linalool, phenllandrene, zingiberine, zingiberol (gingerol, zingirone and shogaol) and resin (18). Positive effect of ginger on blood circulation, gastric secretion and enterokinese were reported by (19). Nigeria is rated as the fifth world producer of ginger with an estimated annual output of 138,000 tonnes (20). Ginger can be considered as one of the best options to fill the gap in preference to antibiotics. Important compounds in ginger are gingerol, gingerdiol and gingerdione which have the ability to stimulate digestive enzyme, affect the microbial activity and anti-oxidative activity (17). The present study was carried out to evaluate the effects of feeding graded levels of gingeras an alternative to anti-biotic growth promoter on finisher broiler chickens.

## Materials and Methods

### Study Area

The experiment was carried out at the Teaching and Research Farm, Department of Animal Science, University of Maiduguri, Borno State Nigeria. Maiduguri is located on latitude 11.5N, longitude 30.05 E and altitude of 364M above sea level in the semi-arid region of North Eastern Nigeria. The annual rainfall range of 500 to 600 mm, relative humidity of range of 30 to 50 % and summer temperature of 40$^{\circ}$C (21).

### Experimental birds and Management.

One hundred and forty four day old Ammo breed of broilers were used for this study. The birds were procured from through a distributor in Maiduguri. Before the arrival of the birds, all sanitary procedures such as cleaning, washing and disinfection of the pen and other equipment were observed. The chicks were individually weighed (325± 6g) at the commencement of the study to ensure no bias were introduced in weight among the treatment groups. The finisher broilers were randomly assigned to four dietary treatments group of thirty six replicated three times in a completely randomized design. The birds were raised in a deep litter system; feed and water were provided *ad libitum* throughout the period of the experiment which lasted for 8 weeks. Routine vaccination schedule for broilers were observed.

**Table 1: Ingredient and chemical composition of Experimental diets for broiler finisher fed graded levels of Ginger as a feed additive**

| Ingredients | T1 (0%) | T2 (2%) | T3 (4%) | T4 (6%) |
|---|---|---|---|---|
| Maize | 52.30 | 52.21 | 48.16 | 46.10 |
| Wheat offal | 13.08 | 12.56 | 12.04 | 11.52 |
| Groundnut cake | 30.62 | 31.23 | 31.80 | 32.38 |
| Bone meal | 3.00 | 3.00 | 3.00 | 3.00 |
| Premix | 0.25 | 0.25 | 0.25 | 0.25 |
| Salt | 0.30 | 0.30 | 0.30 | 0.30 |
| Methionine | 0.20 | 0.20 | 0.20 | 0.20 |
| Lysine | 0.25 | 0.25 | 0.25 | 0.25 |
| Ginger | 0.00 | 2.00 | 4.00 | 6.00 |
| Total | 100 | 100 | 100 | 100 |
| **Calculated Analysis** | | | | |
| Crude protein | 20.00 | 20.00 | 20.00 | 20.00 |
| Crude fibre | 4.20 | 4.22 | 4.24 | 4.27 |
| ME(Kcal/kg) | 2837 | 2779 | 2720 | 2661 |
| Calcium | 1.16 | 1.42 | 1.67 | 1.93 |
| Phosphorus | 0.59 | 1.10 | 1.60 | 1.78 |
| Methionine | 0.11 | 0.12 | 0.13 | 0.10 |
| Lysine | 0.21 | 0.26 | 0.31 | 0.37 |
| **Proximate composition** | | | | |
| Dry Matter | 94.80 | 95.60 | 95.40 | 95.80 |
| Moisture content | 5.20 | 4.40 | 4.60 | 4.20 |
| Crude protein | 20.02 | 20.03 | 20.02 | 20.02 |
| Crude fibre | 3.85 | 3.76 | 3.68 | 3.59 |
| Ether Extract | 10.00 | 11.00 | 12.00 | 13,00 |
| Ash | 2.00 | 2.00 | 2.00 | 2.00 |
| NFE | 64.13 | 63.21 | 63.30 | 62.39 |
| ME(Kcal/kg) | 2766 | 2841 | 2969 | 3004 |

Vitamin premix finisher supplied 1kg: Vitamin A, 500 iu, Vitamin $D_3$, 888,000 iu, Vitamin E, 1200 mg, Vitamin K, 1500mg, Vitamin B, 1000mg, Vitamin $B_2$, 2000mg, Vitamin $B_6$, 1500 mg, Niacin, 1200mg, Pantothemic acid, 2000mg, Biotin, 10,000mg, Vitamin $B_{12}$ 3000mg, Folic Acid,15000mg, Chloride,60000mg, Manganese, 10,000mg, Iron,15,000mg, Zinc, 800mg, Copper, 400mg, Iodine, 80mg, Cobalt, 40mg, Selenium, 8000mg.

**Processing and source of experimental ginger**

The ginger used in this experiment was dried, purchased in Maiduguri metropolis Borno state. It was sorted to remove impurities and the dried form was ground into powder and then sealed in polythene bag before incorporation into the feed.

**Experimental diets**

Four experimental diets were formulated to meet the minimum requirements of the experimental birds. Diet (T1) which served as control contained 0% ginger while diets T2, T3 and T4 had 2, 4

and 6 % inclusion levels respectively.

**Data collection**

Initial weights of birds were taken at the beginning of the study and weekly thereafter, while the final weights were taken at the end of the experiment. Daily feed Intake was measured as feed given minus the left over feed divided by the number of birds multiplied by duration of the experiment in days. The feed conversion ratio is the quantity of feed consumed divided by weight gain. The daily weight gain per bird was computed by dividing the difference between the final weights minus the initial weight divided by number of birds in each group.

**Statistical analysis**

Data collected from the study were subjected to analysis of variance (ANOVA) and where significant differences occurred, means were separated using fisher's least significant difference (22). The results were considered significant at 5% level of probability.

**Table 2: Proximate composition of Ginger (*Zingiber officinale)***

| Nutrients | Values |
|---|---|
| Dry matter | 93.52 |
| Crude protein | 7.93 |
| Ether Extract | 5.77 |
| Crude Fibre | 3.98 |
| Nitrogen free extract | 69.99 |
| Ash | 5.85 |

Values are means of 3 replicates

**Table 3: Growth performance of broiler chicken fed ginger as feed additive.**

| Parameters(g) | T1 (0%) | T2 (2%) | T3 (4%) | T4 (6%) | SEM |
|---|---|---|---|---|---|
| Initial weight | 326.39 | 330.56 | 331.94 | 325.00 | 3.306 |
| Final weight | 1994.00 | 1832.30 | 1920.00 | 2063.30 | 82.34 |
| DFI | 166.15 | 181.82 | 167.09 | 156.92 | 10.29 |
| DWG | 38.55 | 33.66 | 37.09 | 42.23 | 3.07 |
| FCR | $4.33^{ab}$ | $5.72^{a}$ | $4.51^{ab}$ | $3.43^{b}$ | 0.526 |

Means in the same row bearing different superscripts a, b, c differ significantly (P<0.05). SEM- Standard Error of Mean, FCR- Feed conversion Ration. DFI- Daily feed intake, DWG- Daily weight gain

**Table 4: The nutrient digestibility of broiler chicken fed ginger as feed additive**

| Constituents | T1 (0%) | T2 (2%) | T3 (4%) | T4 (6%) | SEM |
|---|---|---|---|---|---|
| Dry Matter | $57.09^{b}$ | $57.50^{b}$ | $59.79^{a}$ | $60.51^{a}$ | 0.300 |
| Crude protein | $41.90^{c}$ | $42.81^{c}$ | $44.92^{b}$ | $46.24^{a}$ | 0.340 |
| Crude fibre | $18.96^{b}$ | $19.85^{ab}$ | $19.06^{b}$ | $20.12^{a}$ | 0.270 |
| Ether Extract | $90.29^{a}$ | $89.67^{ab}$ | $90.06^{ab}$ | $84.73^{b}$ | 1.550 |
| Ash | $22.30^{b}$ | $23.70^{ab}$ | $24.04^{a}$ | $22.43^{b}$ | 0.430 |
| NFE | $47.80^{c}$ | $48.\ 50^{c}$ | $49.07^{b}$ | $50.43^{a}$ | 0.250 |

Means in the same row bearing different superscripts a, b, c differ significantly (P<0.05). SEM- Standard Error of Mean, NFE- Nitrogen free extract

**Results and Discussion**

The proximate compositions of experimental diets are presented in Table 1. The crude protein and metabolizeable energy range values of 20.02 to 20.03 % and 2766 to 3004 kcal/kg of the experimental diets falls within the values recommended by (23) for broiler finisher. The crude fibre range value of 3.59 to 3.85 % recorded in this study is also within the range value of 3.39 to 6.24% recommended for broiler finisher birds. The ether extract value increased as the dietary level of ginger increase. This could be attributed to fat content of ginger. This confirms the earlier report of (24) that ginger is rich in oil. The growth performance indices of broiler chicken fed diets with graded levels of ginger are presented in Table 3. There were no significant ($P<0.05$) difference recorded for final weight, daily feed intake and daily weight gain. The results agrees with ( 25, 26) who in their respective study reported no significant difference in productive performance of broilers fed ginger as feed additive and ginger essential oils to broilers to broilers. However, the results obtained in this study did not agree with the findings of (27) who reported significant difference in final body weight of hubbard strain of broiler chickens fed diets containing 2% supplemented red ginger and birds on the control diets. The variation with the earlier report of (26) may be attributed to cultivar of the ginger, strain of broiler used and environment in which this research was conducted. Studies conducted by (28) observed significant ($P<0.05$) positive effect on the body weight gain when ginger was used in the diet of broilers. The Feed Conversion ratio values for T1, T2, T3 andT4 were 4.33, 5.72, 4.51 and 3.43 respectively. Birds fed dietT4 had the best feed conversion ratio.The result showed that the use of ginger at 6% level as feed additive in broiler fed had significant ($p<0.05$) and positive influence on feed conversion ratio. This result agrees with (28, 29) who in their respective studies reported significant difference ($P<0.05$) in feed conversion ratio in groups of broilers fed diets containing ginger compared to those on the control diets. This may be attributed to the active compounds present in the ginger which stimulates digestive enzymes and improves overall digestion and thus leads to increased feed utilization. A similar study conducted by (30) observed that ginger has ability to increase the digestive and absorptive capacity of the small intestine of commercial broilers by increasing the cryptal depth as well as the absorptive surface area of the intestine i.e. villi length and width. The nutrient digestibility of broiler chickens fed ginger is presented in Table 4. There were significant ($P<0.05$) difference among the dietary treatment groups for dry matter (DM), crude protein (CP), crude fiber (CF), ether extracts (EE) and Ash values. This could be attributed to stimulation of digestive enzymes by bioactive compounds of ginger and thus improvement of overall digestion. According to (31) spices enhanced the activity of pancreatic lipase, amylase, trypsin and chymotrypsin by 22-57 %, 32-51 %, 63-81 % and 12-38 %, respectively. Ginger has been found to enhance pancreatic lipase activity, intestinal lipase, disaccharides, and sucrose and maltase activities of rat ((32). These have been reported to have favorable influence on gut function, which is the primary mode of action for growth promoting feed additives (33).

**Conclusion and Application**

Based on the findings, it is concluded that ginger can be included in broiler finisher diet without detrimental effects however; broilers fed 6% level as additive performed better compared to their counterparts and is therefore recommended.

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