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Full Length Research

Growth and electrolytes response of broiler chickens fed diet containing graded levels of ginger

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ABSTRACT: A feeding trial was conducted to examine the effects of ginger on growth and electrolyte levels of finisher broiler chickens. A total of 120, day-old chicks of Cobb 500 strain were used for the trial which lasted for 28 days. However, before the commencement of the trial, birds were brooded together for a period of 4 weeks (28 days). At the end of the brooding period, the birds were weighed to obtain their initial body weights (IBW) and were randomly assigned to four dietary treatment groups of 30 birds/treatment with 3 replicates of 10 chicks/replicate arranged in a completely randomized design (CRD). Treatment 1 is the negative control, contained 0 gram of ginger, treatments 2, 3 and 4 contained 400, 600 and 800 grams of ginger / 100 kg diet respectively. Feed intake and weight gain were monitored. At the end of study, nine birds from each treatment group consisting of 3 birds from each replicate were slaughtered and their blood samples were collected in non-ethylene diamine tetra-acetic acid (non-EDTA) tubes for electrolytes analyses. Electrolytes analyzed were potassium (K^+), sodium Na^+), chlorine (cl^-) and bicarbonates ($HCO3^-$). Data obtained were analyzed using Analysis of Variance (ANOVA) and means were separated via Tukey's test. There were no significant ($p > 0.05$) differences in the average daily feed intake (ADFI) among the treatment groups. However, there were significant ($p < 0.05$) differences in the average daily weight gain (ADWG) and feed efficiency (FE). Broiler birds fed diet containing 800 g ginger /100kg diet had significantly higher ADWG and FE compared to the control group. From the study also, ginger had no significant ($p > 0.05$) effect on all the electrolytes analyzed. It is therefore concluded that ginger improved ADG and FE but had no effect on ADFI and electrolytes balance of grower-finisher broiler chickens.

Keywords: Broiler chickens, electrolytes, ginger, growth.

INTRODUCTION

Antibiotics have been used as feed additives in poultry diets primarily to enhance broiler growth rates for many years principally due to their favourable effects on poultry growth rates and feed efficiency (Unigwe and Igwe, 2022). Broilers are fast-growing species reaching market weights of about 3 kg in 8 weeks. Therefore, the fast rates at which broiler grows is a potential risk factor for the birds through stress that is further compounded by environmental factors, including poor nutrition, which can significantly reduce farmer profitability, particularly in the commercial setting (Hoerr, 1998).

Supplementing poultry diets with antibiotics at sub-therapeutic levels has been demonstrated to improve animal growth rates according to Cromwell (2002) as they also play the roles of antioxidants (Johnson and Bedford., 2018). It has been shown that the use of antibiotics in poultry diets has some major drawbacks, such as pathogenic microbes showing resistance to antibiotics, antibiotics residues found in the final meat products and alteration to gut micro-flora (Botsoglou *et al.,* 2002). These are perceived to cause harmful effects on the health of consumers, leading to public outcry and rejection of meats

produced with antibiotics (Unigwe and Igwe, 2022). Therefore, their uses in broiler diets have been prohibited resulting in a search for their alternatives in the poultry industry. Different feed additives are been used to see if they could replace the injudicious use of antibiotics in poultry production. Phytobiotics which are natural growth promoters, including ginger have been suggested (Unigwe and Igwe, 2022) as an alternative.

Ginger (*Zingiber officinale*) is much pronounced for its diverse inherent bioactive constituents, such as gingerol, shogoals and zingerone. These compounds have been shown to possess potent antioxidants, anti-inflammatory and antimicrobial activities. These attributes of ginger are responsible for its positive effect on poultry overall health and improved performance (Ali *et al.,* 2008). Since the equilibrium of electrolytes in the broiler chicken is physiologically very critical to their overall well-being and performance, therefore; disruptions in the electrolyte balance can result in a range of health-related problems, such as dehydration, muscular weakness and diminished growth rates (Davies and Wray, 2017). Therefore, the objectives of this study are to assess the effect of ginger on broiler growth parameters (ADFI, ADG and FE) and electrolyte balance.

MATERIALS AND METHODS

Experimental site

The study was carried out at the Rivers State University Teaching and Research Farm, Port-Harcourt situated at an elevation of 18 meters above sea level, it is located North of Rivers State University campus at latitude 4°48' N and longitude 6°58' E (David *et al.,* 2019).

Management of broiler chicks

A total of 120 (*Cobb 500*) day-old chicks were utilized in the study. Thorough cleaning and disinfection of their pens were undertaken before the arrival of the chicks. The chicks were brooded for 4 weeks to provide warmth for the chicks. At the end of the brooding period, the chicks were weighed to obtain their initial body weight and were allotted to respective dietary treatments and fed for a period of 4 weeks. Feed intakes were closely monitored, and water was provided *ad libitum*.

Experimental design and diets

There were 30 birds/treatment group replicated 3 times, each replicate consists of 10 birds, arranged in acompletely randomized design (CRD). Four experimental diets were formulated and all are similar in dietary nutrient contents except that levels of ginger supplemented differ. Diet 1(T_1) was the negative control which contained 0 g of ginger / 100 kg, diets 2, 3 and 4 (denoted T_2, T_3 and T_4) contained 400, 600 and 800 g of ginger/ 100 kg of diet, respectively. The ginger was sundried for one week and later ground into powdered form before supplementing at various graded levels in the commercial diet. They were thoroughly mixed properly into the diets to ensure uniformity. The commercial diet was produced at Umberik Farms, Rivers State, Nigeria with the following percentage of feedstuffs shown in Table 1.

Data collection

Birds were weighed again at the end of the experiment to obtain their final body weight, average daily feed intake (ADFI), average daily weight gain (ADWG) and feed efficiency (FE) were computed.

Blood sample collection (electrolytes analyses)

Nine (9) birds from each treatment group comprising 3 birds from each replicate were slaughtered and blood samples were collected in non-ethylene diamine tetra-acetic acid (non-EDTA) tubes for electrolytes analyses. Electrolytes analyzed were K^+, Na^+, Cl^- and $HCO3^-$ and was done using the method of AOAC (2000).

Statistical analyses

Data obtained were subjected to analysis of variance (ANOVA) using the general linear model (GLM) procedure of SAS (1998). Treatment means were compared using Tukey's test. The model was: $Y_{ij} = \mu + X_i + E_{ij}$; where Y_{ij}= individual observation of the treatment, μ = population mean, X_i= effect of the i^{th} level of ginger and E_{ij}= the error term. An α-level of 0.05 was used for all statistical comparisons.

RESULTS

Effect of feeding ginger on growth performance of broiler finisher chickens

The results of the growth performance of grower-finisher broiler chickens fed ginger-based diets are shown in Table 1. There were significant ($p < 0.05$) differences in the final body weight among the treatment groups. There was an increase in weight gain with increasing levels of ginger. The group of birds fed 800 g / 100 kg diets had significantly ($p < 0.05$) higher daily body weight gain (88 g/day) compared to the other treatment groups. The control group had the lowest body weight gain (44 g/day). Feed efficiency (FE) followed a similar trend as ADG.

Table 1. Mean growth responses of broiler chickens fed varied levels of ginger-based diets.

Parameter	Treatments (Levels of ginger g/100kg)				SEM
	0	400	600	800	
Initial Body Weight (kg)	1.05	1.04	1.05	1.05	0.02
Final Body Weight (kg)	2.35^{c}	3.42^{b}	3.79^{a}	3.84^{a}	0.07
ADFI (g)	165.00	164.45	165.00	164.51	0.01
ADWG (g)	44.00^{d}	62.00^{c}	78.00^{b}	88.00^{a}	0.03
FE	0.27^{d}	0.38^{c}	0.47^{b}	0.54^{a}	0.01
Mortality	-	-	-	-	

^{a,b,c,d}Means within each row with different superscripts differed significantly ($P < 0.05$). **SEM** = Standard error of the mean, FE = feed efficiency.

Table 2. Electrolytes responses of broiler chickens fed varied levels of ginger-based diets.

Parameter	Treatments				SEM
	T_1	T_2	T_3	T_4	
K^+ (mmol/L)	4.43	4.40	4.40	4.40	0.02
Na^+(mmol/L)	134.78	135.00	135.00	135.00	0.10
Cl^-(mmol/L)	68.78	69.00	69.00	69.00	0.12
$HCO3^-$ (mmol/L)	25.00	25.00	25.00	25.00	0.01

Keys: SEM = Standard error of the mean; K^+= Potassium, Na^+= Sodium, Cl^-= Chloride and $HCO3^-$= Bicarbonate.

Effect of feeding ginger on electrolytes balance of broiler finisher chickens

The results of the effect of feeding diets in which ginger was added, on electrolyte levels of broiler chickens are shown in Table 2. There were no significant ($p > 0.05$) differences in all the electrolytes studied for all the dietary treatment groups.

DISCUSSION

The results of this study suggested that ginger is not an anorectic agent as birds of the four treatment groups readily consumed their diets in a similar fashion without any signs of feed rejections; although the different treatment groups gained weights at different rates. In the past, the use of antibiotics at sub-therapeutic levels to enhance animal growth had been employed to enhance growth and reproductive performances (NRC, 2012). At present, due to health implications as a result of antibiotic residues in the final meat products coupled with the resistance of some strains of pathogenic micro-organisms to some antibiotics and public outcry, its use in non-ruminant diets has been banned (Hoerr, 1998; Cromwell, 2002.

With the ban on the use of antibiotics in the diets of farm animals, particularly for poultry and swine, animal producers are often strategizing for alternatives to antibiotics albeit to ensure sustaining and maintaining optimum animal performance without compromising animal welfare. Oleforuh-Okoleh*et al.* (2014) have advocated that ground ginger and garlic improved broiler growth, meat quality and other economic indices of production. Later, Unigwe and Igwe (2022) further supported the findings of Oleforuh-Okoleh *et al.* (2014) that ginger and garlic powders also improved the performance and haematological parameters of broiler chickens. In animal nutrition, growth rate and haematological parameters are some of the major means of assessing the soundness or efficiency of a diet of the animal (Babatunde *et al.,* 1992; Ekenyem and Madubuike, 2006).

To this extent leaning on the clues from the findings of Oleforuh-Okoleh *et al.* (2014) and Unigwe and Igwe (2022) it is not gainsaying that ginger improved the performance of grower-finisher broiler chickens in this current study. In other words, the findings of growth improvements and feed efficiencies found in this current study with ginger diets compared with the negative control treatment value are in agreement with those of Oleforuh-Okoleh *et al.* (2014) and Unigwe and Igwe (2022). For instance, in this study, the ADG of T_2, T_3 and T_4 were superior by 62, 77 and 100% over that of T_1, respectively. Similarly, the FE of T_2, T_3 and T_4 were 41, 74 and 100%, respectively superior compared to that of T_1. These findings again are in agreement with the data of Karangiya *et al.* (2016). From the economic standpoint of broiler production, these improvements in growth rates and feed efficiencies of the birds on ginger-based diets translate to phenomenal gains as per economic benefits on the part of the broiler farmer's profit margins. Again, it is not gainsaying that some of the bioactive compounds found in ginger, particularly gingerol,

gingerdion and shogoals due to their strong antioxidant, antibacterial and immunomodulatory activities, including improvements in the activities of digestive enzymes (Al-Khalaifah *et al.,* 2022) would have been responsible for the observed benefits in the ginger-groups over the negative control group. However, the ingestion of the ginger-supplemented diets had no effects on all electrolytes studied and this is contrary to the findings of Airhomwanbor *et al*. (2023) which showed that there were significant differences in sodium ion, chloride ion, potassium ion and bicarbonate ion when ginger was administered to Winster rats at 400 mg/kg. However, the findings in this study correspond with Muhammad *et al*. (2024) which showed that ginger supplement had no significant differences in chloride and serum electrolytes of broiler chicken.

Conclusion and Recommendation

It was concluded that ginger improved the ADWG and FE of finisher broiler chickens. Therefore, it is recommended that ginger be used at 800g/ 100kg in a diet to enhance broiler production. It was also concluded that ginger had no effects on electrolytes.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

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