GROWTH PERFORMANCE AND GUT RESPONSE OF BROILER CHICKENS FED THREE SELECTED PHYTOADDITIVES

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ABSTRACT

This study was conducted to determine the growth performance and gut responses of broiler chickens fed Xylopia, Ginger and Garlic feed additives. A total of 180 Ross 308 1-day-old chicks were used. There were four treatments which were replicated three times. Each replicate had fifteen birds. The experiment was arranged in a completely randomized design (CRD). Control (T1) diets without xylopia, ginger and garlic were formulated while T2, T3, and T4 had 10g of xylopia, ginger and garlic/kg of feed, respectively. The diets and water were offered to the birds ad libitum for 56 days. The birds were weighed on a weekly basis, feed intake, weight gain and feed conversion ratio were calculated. Three birds each per replicate with representative mean live weight were selected for growth performance evaluation and gut responses. Data collected were analysed using SPSS version 21 and significant means were separated using Duncan's Multiple Range Test of the same statistical package. Result obtained showed significant differences in all growth parameters except FCR and average cost per weight gain. The xylopia group had the highest final weight gain and the most economical FCR. There was reduction in the population of microbes in the birds fed the phtyo-additive compared to the control, this confirm the antimicrobial properties of the various additives used. The study revealed that adding 1% xylopia to broiler feed improved the growth performance and significantly reduced the population of gut microbes and therefore recommended for broiler production.

Keywords: Xylopia, Ginger, Galic, Gut microbes and Gut histomorphometry

INTRODUCTION

Successful poultry production depends on optimal feed intake throughout the growing period. The optimal feed intake required for optimum growth and healthy living is a function of several factors such as quantity and quality of feed, type of feed, physical form of feed and proper management system. Also, according to Oluyemi and Roberts (2000), the success of poultry venture depends on the birds having good health, nutrition and good management. Feed additives are important materials that can improve the efficiency of feed utilization and animal performance. With the ban of antibiotics usage in animal nutrition due to the emergence of microbial resistance, alternative growth promoters need to be sought for. Some studies have indicated that various plants extracts can improve feed conversion ratio, improve carcass quality, decrease the market age of broiler and reduce their rearing cost (Muhammed *et al.,* 2009). Example of these phyto-additives are garlic (*Allium sativum*), ginger (*Zingiber officinale*), negro pepper (*Xylopia aethiopica*) etc. Tollba and Hassan (2003) found that garlic has a natural feed additive, improved broilers growth, feed conversion ratio (FCR), and decreased mortality rate. Ginger also has been reported to contain gingerol, gingerdione and gingerdiol that also possess strong antioxidant activity. Negro pepper has pharmaceutical and medicinal properties which include antibiotics, enzymes, hormones and according to Isikwenu and Udomah (2015), its phytochemical contents such as essential oils, phenols, flavonoids and carotenoids, the spice is used in diets for nursing mothers to stabilize the gastrointestinal tract (Omodamiro *et al.,* 2012), therefore, this study was design to determine the growth performance, gut response of broilers chickens fed three different phyto-additives (Ginger, Garlic and Negro pepper).

MATERIALS AND METHODS

Experimental Site: The study was carried out at Poultry Unit, Teaching and Research Farm Ogbomoso, Ladoke Akintola University of Technology (LAUTECH).

Procurement, Processing and Preparation of Experimental Diets: The Ginger, Garlic and Negro pepper were procured from a reputable spice market, they were peeled, cleaning, dried and grounded to form meals. The dietary treatment which were fed *ad libitum*, T1 consists of feed with zero addition of the three additives, T2, T3, T4 diets had 10g garlic, ginger and negro pepper per kg feed, respectively

Experimental birds and Management: A total of 180 Ross 308 strain 1-day-old broiler chicks were randomly allocated to four dietary treatments with 3 replicates which contains 15 chicks in a completely randomized design for 8 weeks. On arrival, the chicks were kept in brooding house for 21 days under a perfect brooding conditions, they were given anti-stress and all necessary vaccination as instructed by the veterinary personnel on the farm.

Data Collection

Weekly weight of the birds was carefully taken and recorded using sensitive scale, daily feed intake, average feed intake, total feed intake, feed conversion ratio, cost per/kg weight gain, cost per/kg feed and final weight gain were all determined. **Microbial analysis:** Digesta at the 8th week from three birds were randomly selected from each dietary, slaughtered, 5cm jejunal sessions were taking and fixed in 10% formalin while digesta aseptically harvested from the gizzard, duodenum, jejunum and caecum into sterile bottles were all sent to reputable laboratory for permanent slide preparations and digesta analysis respectively.

Statistical Analysis: Data collected were analyzed by one way analysis of variance (ANOVA) using SPSS version 21 computer software and significant mean were separated using Duncan's Multiple Range Test of the same statistical package.

RESULTS AND DISCUSSION

The growth response (Table 1) of broiler chicks fed three selected phyto additives at the finisher phase so that group fed Xylopia (1%) had the highest final weight gain (1858.50g), followed by those fed garlic and ginger which recorded 1583.33g and 1572.33g respectively, the birds fed control had the lowest final weight gain (1540.50g). The result obtained from this study is an indication that Negro pepper is an additive that could be used to improve the growth of broiler chickens. However, Al-Kassie *et al.,* (2011) reported that Negro pepper improved both feed intake and growth of broiler chickens. The result is in agreement with Isikwenu and Udomah *et al.* (2015) who reported improvements in the feed intake of broilers fed *Xylopia aethiopica.* The growth promoting effects of negro pepper in broiler chickens may be attributed to the presence of phytochemical compounds in the fruits (carbohydrates, flavonoids, alkaloids, steroids, saponins and tannins), which have biological activities such as antioxidant, anti-microbial and pharmacological effects (Isikwenu *et al.,* 2014).

Table 1: Growth Performance of Broiler Chickens Fed Three Selected Phyto-additives

Parameters	0%	Xylopia (1%)	Ginger (1%)	Garlic (1%)	SEM
IW (g)	37.47	37.13	37.10	37.20	-
FW (g)	1,540.50^{b}	1,858.50^{a}	1,572.33^{b}	1,583.33^{b}	49.99
TWG (g)	1,503.03^{b}	1,821.37^{a}	1,535.23^{b}	1,546.13^{b}	47.00
ACWG (₦)	621.79	523.53	564.21	595.21	17.24
ATFI (g)	3,585.66^{a}	3,654.68^{a}	3,295.38^{b}	3,516.58^{ab}	48.34
ADFI (g)	63.99^{a}	65.26^{a}	58.85^{b}	62.80^{ab}	0.86
ACFI (₦))	924.89^{a}	942.91^{a}	850.21^{b}	907.28^{ab}	12.47
FCR	2.41	2.03	2.19	2.31	0.67

^{ab}: Mean along the same row with different subscripts are significantly different ($p<0.05$).KEY; IW = Initial weight, FWG = Final weight Gain, TWG= Total weight gain, ACWG=Average cost per weight gain, TFI=Total feed intake, ATFI=Average total feed intake, ADFI=Average daily feed intake, ACFI=Average cost of feed intake, FCR=Feed conversion ratio, SEM=Standard error of mean.

The Results of gut ecology (Table 2) showed that there were significant differences in the population of Enterobacter aerogens, Escherichia coli, Staphylococcus aureus, and Pseudomonas aeruginosa in the gizzard. Despite the benefits of the microbiota in producing a stable intestinal environment, in unfavourable situations, they can act as pathogens, produce toxic metabolites and impair the productive performance of birds. In the gizzard, the population of Escherichia coli was the highest in

T1 and were reduced in T2. This could be due to the active ingredients in xylopia which possess antimicrobial properties. This is in consonance with the earlier reports of Ilusanya and Ezekwesili (2012), who reported that the reduction in microbial population of birds fed xylopia may be attributed to the presence of several compounds in the fruits. The population of Escherichia coli was also reduced in T3 and T4. Report of Tekeli (2011) shows that ginger in the diets stimulate lactic acid bacteria and decreases pathogenic bacteria. Staphylococcus aureus had the highest population in T1, but was reduced in T2, T3 and T4. This is in tandem with the report of Tatsadjieu et al. (2003) who reported that xylopic acid and four other isolates from the ripe fruits of Xylopia aethiopica, have been examined for antimicrobial activity against Staphylococcus aureus, Escherichia coli, and Pseudomonas aeruginosa. Also, the population of Staphylococcus aureus was the lowest in the birds fed T4, this could imply that the active ingredients in garlic has a greater effect on Staphylococcus aureus in the gizzard of broiler chickens. Pseudomonas aeruginosa which was present in the control group was completely absent in T2, T3 and T4, which shows that xylopia, ginger and garlic has antibacterial effect.

Table 2: Gizzard, duodenum, jejunum and caecum microbial load of broiler chickens fed three selected phyto-additives

Treatments	Site	Control T1	Xylopia (1%) T2	Ginger (1%) T3	Garlic (1%) T4	SEM
Ea		13.25^{b}	107.25^{a}	0.50^{c}	4.00^{c}	11.41
Ec	Gizzard	820.25^{a}	415.50^{b}	1.25^{d}	265.50^{c}	77.08
Sa		141.75^{a}	36.75^{c}	113.50^{b}	5.25^{d}	14.39
Pa		1.25^{a}	0.00^{b}	0.00^{b}	0.00^{b}	0.15
Ea		30.75^{a}	23.00^{b}	0.00^{d}	1.50^{c}	3.45
Ec	Duodenum	105.25^{a}	18.75^{c}	49.00^{b}	24.00^{bc}	9.78
Sa		283.25^{a}	4.50^{b}	15.25^{b}	23.25^{b}	30.26
Pa		0.00	0.00	0.00	0.00	0.00
a		3.00^{a}	1.25^{b}	1.50^{b}	1.50^{b}	0.23
Ec	Jejunum	3.50^{a}	0.00^{c}	2.00^{b}	1.50^{b}	0.35
Sa		521.00^{a}	4.00^{d}	203.75^{c}	421.75^{b}	51.83
Pa		0.00	0.00	0.00	0.00	0.00
Ea		40.00^{a}	0.00^{c}	0.00^{c}	3.25^{b}	4.36
Ec	Caecum	146.00^{a}	6.00^{d}	23.75^{b}	18.25^{c}	14.63
Sa		20.25^{b}	4.75^{d}	26.50^{a}	16.50^{c}	2.07
Pa		0.00	0.00	0.00	0.00	0.00

Key: Ea = *Enterobacter aerogens*, Ec = *Escherichia coli*, Sa = *Staphylococcus aureus*, Pa=*Pseudomonas aeruginosa,* ^{abcd}=Means within the same row bearing different superscript are significantly different ($p<0.05$).

The broiler chickens' gut responded differently to different feed additives. Although the mechanism of action of phytoadditives has not been establish in detail but research (Gavris *et al*., 2019) established improvement in the gut mucus secretion and this helps protecting the epithelium from bacteria by promoting their clearance and separating them from the epithelial cells, thereby inhibiting inflammation and infection.

Table 3 Histomorphometry of broiler chickens fed three phyto-additives

Parameters	Control	Xylopia	Ginger	Garlic	SEM
Villi Height (µm)	4401.67^{a}	3028.93^{b}	3198.48^{b}	4171.62^{a}	176.59
Villi width (µm)	555.01	500.57	444.92	388.73	33.36
Crypt Depth (µm)	1113.13^{a}	1272.90^{a}	809.25^{b}	1366.24^{a}	65.44
VH:CD Ratio	4.12^{a}	2.44^{b}	4.14^{a}	3.08^{ab}	0.25
Muscular Thickness (µm)	880.03^{b}	807.06^{b}	927.91^{ab}	1048.77^{a}	27.03

CONCLUSION

The improvement in the growth performance and reduction in the pathogenic microbial population in the intestine of broilers chicken in this study indicate that *Xylopia aethiopica* has growth promoting potentials and can serve as a natural alternative to antibiotics in broiler production with no adverse health implication. Also, the use of xylopia, ginger and garlic can help to reduce the population of the microbes in the gut of broiler chickens.

Recommendation

It can be recommended that 1% Xylopia, ginger and garlic can be given to broiler chicken to improve their growth potential and also in replacement of antibiotics because of their antibacterial and antioxidants activities.

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