EFFECT OF DIETARY SUPPLEMENTATION OF ETHIOPIAN PEPPER (*XYLOPIA AETHIOPICA),* CLOVES (*SYZYGIUM AROMATICUM*) AND THEIR COMPOSITE ON GROWTH PERFORMANCE OF BROILER CHICKENS.

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ABSTRACT

This study investigated the effect of dietary supplementation of Ethiopian pepper (X*ylopia aethiopica)*, clove (S*yzygium aromaticum*) and their composite on the growth performance of broiler chickens. Three hundred and sixty unsexed Ross broilers were used for the study. Four experimental diets were formulated for starter (0-28 days) and finisher phases (29-56 days); Diet 1 was the control without Phytogenic supplementation, Diet 2 (supplemented with 1% Ethiopian pepper (EP)), Diet 3 (supplemented with 1% Clove (CL)) and Diet 4 (supplemented with 1% mix of equal quantity (0.5 % each) of Ethiopian pepper and clove (EPCL)). Each treatment was replicated 6 times with 15 birds per replicate. Growth response was measured weekly for the starter and finisher phases. Data obtained were subjected to a one-way analysis of variance using SAS 2000 and significant means were separated using Tukey's test in the same software. At day 28, dietary supplementation of EPCL increased ($P<0.05$) live weight (LW) (660.34 g), weight gain (WG) (599.66 g) with improved feed conversion ratio (FCR) (0.98). At day 56, LW and WG were also increased ($P<0.05$) with EPCL supplementation. It was concluded that EPCL can be supplemented in the diet of broilers for increased performance.

KEYWORDS: Broilers, Ethiopian pepper, cloves, growth performance

INTRODUCTION

Broiler production plays a significant role in human nutrition as a good source of meat for the increasing population, but its production is challenged with diseases that initially have been combated by the use of antibiotics (Gaskins et al., 2002). In response to concerns about the issues of antimicrobial-resistant bacteria in humans associated with the consumption of meat from antibiotic-treated broilers, there is a strong advocate against the use of antibiotics (Laxminarayan et al., 2015, Haque et al., 2020). Therefore there is an intensive search to explore the use of alternatives such as phytogenic plants (Shittu et al., 2002; Radzikowski and Milczarek, 2022).

Phytogenics are a group of natural growth promoters or non-antibiotic growth promoters, derived from herbs, spices or other plants (Banerjee et al., 2011). Ethiopian pepper *(Xylopia aethiopica*) and cloves (*Syzygium aromaticum*) belong to these categories of plants that could serve as phytogenic feed additives due to their active constituents and nutritive values (Cortés-Rojas et al., 2014). Ethiopian pepper act as a potential therapeutic weapon against various human and animal diseases (Ogbonnia et al., 2008). Clove is known to possess various therapeutic uses which include pain amelioration, improvement of digestion, protection against internal parasites and it acts as an antimicrobial agent against fungi (Burt and Reinders, 2003).

There are various reports on phytogenic plants to have the potential to replace antibiotics growth promoters (Mishra and Singh, 2000; Deepak et al., 2002) however, very few of them have been investigated. There also exists a dearth of information about the potency and effectiveness of Ethiopian pepper and cloves as potential and sustainable feed additives in poultry production. Therefore this study

seeks to determine the effect of dietary supplementation of Ethiopian pepper, cloves and their composite on the growth performance of broiler chickens.

MATERIALS AND METHODS

Experimental site

The experiment was carried out at the Poultry unit of the Directorate of University Farms (DUFARMS) Federal University of Agriculture, Abeokuta, Alabata, Ogun State, Nigeria.

Test ingredients and processing

The test ingredients which are dried Ethiopian pepper and clove were purchased from Kuto market in Abeokuta Ogun State, Nigeria. The properly dried fruit of clove and Ethiopian pepper were milled to particle size 0.2mm using a Kenwood blender and stored in plastic containers prior to diet formulation and commencement of feeding trial.

Experimental birds and management

Three hundred and sixty (360) unsexed Ross broilers were purchased from Agric International Technology and Trade Limited (AGRITED) hatchery in Ibadan, Nigeria. The necessary biosecurity measures were observed prior to the arrival of the broiler chicks. The birds were reared on a deep litter system and external heat (electric bulb and charcoal) was provided in the poultry pen.

Experimental design and dietary treatment

The broilers were allotted on a weight equalisation basis to four dietary treatments using a completely randomised design. Each treatment has six replicates with 15 birds per replicate. The formulated diet consists of a control (Diet 1) (without Phytogenic supplementation), Diet 2 (supplemented with 1% Ethiopian pepper (EP)), Diet 3 (supplemented with 1% Clove (CL)) and Diet 4 (supplemented with 1% mix of equal quantity (0.5% each) of Ethiopian pepper and clove (EPCL)). The diets were formulated (Table 1) for the starter (0-28 days) and the finisher phases (29-56 days) based on the nutrient requirement guide for Ross 308 (Ross Broiler Nutrition Specifications 2016). The experiment lasted for eight weeks while feed and water were supplied ad-libitum during the experimental period. No in-feed antimicrobials, anti-coccidal drugs or antibiotics were fed to the birds throughout the duration of the study.

Table 1: Composition of experimental diet

Ingredients (%)	Starter (0-28 days)	Finisher (29-56 days)
Maize	54.00	63.00
Soya meal	24.00	19.00
Wheat offal	13.00	10.00
Fish meal	3.00	2.00
Bone meal	3.00	3.00
Oyster shell	2.00	2.00
*Vitamin/Mineral Premix	0.25	0.25
Salt	0.25	0.25
Lysine	0.25	0.25
Methionine	0.25	0.25
Total	**100**	**100**
Determined nutrients (%)		
**Metabolised energy (kcal/kg)	2,827.80	3,078.80
Crude protein	23.41	20.41
Ether extract	3.62	3.32
Crude fibre	3.33	3.21
Calcium	1.34	1.25
Phosphorus	0.66	0.61

*Starter Premix: Vit. A 10,000,000 (iu), Vit D3, 2,000,000 (iv), Vit. 23,000(mg), Vit.k3 2000 (mg), Vit. B1, 1800 (mg), Vit. B2 5,500 (mg), Niacin 27, 500mg, Pantothenic acid 750mg Vit B6 3,000mg, Vit B12 15mg, folic acid 750mg, Biotin H2 60mg, chlorine chloride 300,000 mg, Cobalt 200mg, Copper 300mg, Iodine 1000mg, Iron 20,000mg, Manganese 40,000 (mg), Selenium 200mg, Zinc 30,000mg, Anti-oxidant 1,250mg.

*Finisher premix-Vit. A. 5,500,000 (iu), Vit D3. 1500,000 (iu), Vit E. 10,000 (mg), Vit.k3 1,500 (mg), Vit. B1, 1,600 (mg), Vit. B2 24,000 (mg), niacin 20,000mg, pantothenic acid 5,000mg vit

B6 1,500mg, Vit. B12 10mg, folic acid 500mg, Biotin H2 750mg, chlorine chloride 175,500 mg, cobalt 200mg, copper 300mg, iodine 1,000mg, iron 20,000mg, manganese 40,000 (mg), selenium 200mg, zinc 30,000mg, anti-oxidant 1,250mg.

**Estimated using the Nutrient Requirement of Poultry, NRC (1994) formulae, ME = 26.7 (%Dry matter) + 77 (%Ether extract) − 51.22 (%Crude fibre)

Growth performance

The live weight of the birds per pen (*n = 6 per treatment*) was measured weekly while the weight gain was computed as the difference between initial weight and final weight. Daily feed intake was computed as the difference between the feed offered and leftovers while feed conversion ratio (FCR) was calculated as the ratio of feed consumed to weight gain.

Statistical analysis

Data collected were subjected to a one-way analysis of variance using SAS statistical software (SAS, 2000) to determine the effect of phytogenic plant (Ethiopian pepper, Clove, and Ethiopian pepper and clove composite) supplementation. Differences between mean values were separated using Tukey's Test in SAS Software and a significant difference was considered at probability $P< 0.05$.

RESULTS AND DISCUSSION

Performance of broiler

Table 2 shows the growth performance of broilers fed diets supplemented with phytogenic additives. At day 28, broilers fed the diet supplemented with EPCL had increased ($P<0.05$) live weight (LW). This is similar to the improved performance obtained when different concentrations of *Xylopia aethiopica* dried fruits were given in drinking water to broilers and also similar to the outcome when Gendox® was used as an antibiotic growth promoter in broilers (Isikwenu et al., 2014). This observation indicates that phytogenic plants have growth-promoting potentials just like antibiotics. Supplementation of EPCL increased ($P<0.05$) WG and improved FCR when compared to other treatments. This is in agreement with the report of Aji et al. (2011), who stated that phytogenic additives like garlic (powder or aqueous extract) as an additive in broiler chicken improved body weight gain and FCR. The increase in WG observed for broilers fed diet supplemented EPCL could be attributed to the synergistic growth-promoting properties of phytogenic additives. Improved WG and FCR following the use of a mix of phytogenic additives were also reported by Brenes and Roura (2010). Broilers fed the diet supplemented with EPCL had the lowest ($P<0.05$) mortality while those fed the control diet and those fed diet supplemented EP had the highest ($P<0.05$) mortality. The significantly reduced mortality observed with EPCL supplementation in the diet of broilers establishes the health promoting effect of the constituents of the phytogenic mix. This also confirms the report of Upadhaya and Kim (2017) who reported that the administration of phytogenic preparations at small doses improves the health and productivity of animals. Feed intake (FI) was not significantly ($P>0.05$) affected by phytogenic supplementation at day 28

At day 56, the LW and WG increased ($P<0.05$) with supplementation of EPCL as observed on day 28. This improvement implies that there is an enhancement in nutrient utilisation due to the active constituent of phytogenic additives. This is in Tandem with the report of Oso et al. (2019) who observed increased body weight gain in broilers fed the diet supplemented with 1% phytogenic blend (*Cynodon dactylon*, *Aerva lanata* and *Piper nigrum*). The FI was significantly ($P<0.05$) affected at day 56 in which broilers fed the diet supplemented EPCL had increased ($P<0.05$) feed intake followed by those fed diet supplemented CL. The differences observed at these stages of growth agreed with the report of a previous study by Hernandez et al. (2004) who observed that the growth response of broilers fed with phytogenic additives acts in an age-dependent manner with different responses at various age groups. The increased feed intake observed for broilers fed EPCL supplemented diet implies that the phytogenic mix improves digestion to encourage feed intake. The bioactive compounds contained in phytogenic additives encourage secretions of endogenous digestive enzymes, improves liver function (Al-Kassie, 2009) and nutrient digestion (Lee et al., 2004). Broilers fed the diet supplemented CL had poor ($P<0.05$) FCR compared to other treatments. These indicates that the increased feed intake did not result in better weight gain and this suggests that there was reduced protein utilisation which affected tissue accretion. No mortality was observed for broilers fed the diet supplemented with EPCL at day 56. This confirms the

effectiveness of the synergistic effect of the active biological components (alkaloids, saponins, flavonoids, tannins, pectins and organic acids) in phytogenic additives which exerts antioxidant and antibacterial effects and support immunity in animals as reported by Kostadinović and Lević (2018).

Table 2: Performance of broilers fed diet supplemented with Ethiopian pepper, cloves, and their composite.

	Phytogenic supplementation					
Parameters (g)	**Control**	**EP (1%)**	**CL (1%)**	**EPCL (1%)**	**SEM**	**P-value**
Initial weight	60.98	61.54	62.50	60.68	2.20	0.36
Day 28						
live weight	576.12^{b}	480.21^{c}	560.32^{b}	660.34^{a}	35.70	0.03
Weight gain	515.14^{ab}	418.67^{b}	497.82^{ab}	599.66^{a}	38.80	0.04
Feed intake	601.23	595.10	589.50	586.50	42.11	0.20
FCR (g/g)	1.17^{ab}	1.42^{a}	1.18^{ab}	0.98^{b}	0.09	0.02
Mortality (%)	6.25^{a}	5.89^{a}	4.17^{b}	2.08^{c}	2.30	0.02
Day 56						
live weight	2150.23^{b}	2144.34^{b}	1933.26^{c}	2396.42^{a}	77.55	0.01
Weight gain	1574.11^{b}	1664.13^{b}	1372.94^{c}	1736.08^{a}	70.20	0.02
Feed intake	2489.23^{b}	2525.35^{b}	2586.98^{ab}	2605.88^{a}	149.40	0.03
FCR (g/g)	1.58^{b}	1.52^{b}	1.88^{a}	1.50^{b}	0.10	0.01
Mortality (%)	5.21^{a}	3.20^{b}	3.50^{b}	0.00^{c}	1.71	0.04

^{ab}Means on the same row with different superscripts are significantly different ($P<0.05$) FCR= Feed conversion ratio

SEM= Pooled standard error of the mean

CONCLUSION

The synergistic effect from the combination of Ethiopian pepper and cloves (EPCL) supplementation increased weight gain, improved FCR and reduced mortality in broilers. Therefore dietary supplementation of EPCL can function as a suitable alternative to antibiotics.

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