GROWTH AND ECONOMIC PERFORMANCE OF STARTER BROILER CHICKENS FED DIETS CONTAINING PHYTOGENIC BLEND AS FEED ADDITIVE

***Adeyeye, E. A[1]; Kareem, D. U[1]; Amos, A. T[1]; Iyanda, A. I[2]; Idowu, O. P. A[2,3]; Idowu, K. R[2]; Sobayo, R. A[1]; Oso, A. O[1]**

[1]Federal University of Agriculture, College of Animal Science and Livestock Production, Animal Nutrition Department,

[2]Federal University of Agriculture, College of Animal Science and Livestock Production, Animal Production and Health Department,

[3]Federal University of Agriculture Abeokuta, Agricultural Media Resources and Extension Centre,

***Correspondence**: adeyeyeea@funnab.edu.ng*

ABSTRACT

The quest for antibiotic free poultry products has necessitated the need for organic antimicrobial sources that will not be detrimental to animal and human health. A 21 days study was conducted to examine the economics and growth performance of starter broiler chickens fed diets containing phytogenic blend (PB). 240-day old Cobb 500 broiler chicks were randomly assigned to 6 dietary treatments, which was replicated 5 times. A basal diet (T1), Oxytetracycline + basal diet (T2), PB was added to basal diet at 5g/kg (T3), 10g/kg (T4), 15g/kg (T5), 20g/kg (T6). Data on body weight, feed intake were taken and weight gain, feed conversion ratio were calculated. The prevailing market price of ingredients and selling rate per kilogram live broiler chicken were used for the economic analysis. Data obtained were subjected to one-way analysis of variance in a completely randomized design. Final weight and weight gain of birds in T1, T2, T3, T4 and T5 were higher and statistically similar (P <0.05). Feed intake was higher (P <0.05) for birds in T3. Feed conversion ratio was statistically similar for T1, T2, T3 and T4. Feed cost/kilogram, Feed cost/bird, feed cost/weight gain and feed cost differential increased (P <0.05) as the levels of the PB increased in the diets. Revenue was statistically similar for T1, T3, T4 and T5. Gross margin was (P <0.05) best for T1 and worst for T6. It was concluded that supplementing starter broiler chicken diets with this PB should not exceed 15g/kg for improved weight gain.

Key words: Antimicrobial, economics, growth, organic, phytogenic

INTRODUCTION

Feed additives are products used in animal nutrition for purposes of improving the quality of feed and or to improve the animals' performance and health. In the past, antibiotics were the most commonly used feed additives in poultry feeds as growth promoter. However, their use in poultry production has been banned by World Health Organization (WHO) (Charis, 2000) because of public health concern regarding their residues in the animal products and the development of antibiotic resistance in bacteria (Schwarz *et al*., 2001; Lee *et al*., 2004). There is increase in consumer demand for poultry products free from antibiotic residues (Demir *et al.,* 2005). Feed producers are adopting different nutritional strategies to replace antibiotics with organic feed additives such as spices, herbs and forages (Singh *et al*., 2015). The use of phytogenic feed additives like ginger, garlic, black pepper, clove, thyme, pepper fruit and the likes as non-antibiotics in poultry production is gaining popularity. Reports have shown that utilization of these phytogenic substances impart good health and pose no detrimental effects on growth of broiler chickens (Ndelekwute *et al*., 2015; Afolabi *et al.*, 2017). Positive reports on single utilization of these phytogenic abound and there are many reports of combining two or three of them for possible synergistic effects. However, there is scanty information on blends of phytogenics in the diet of poultry; therefore, the need to access the economics and growth performance of starter broiler chickens fed diets containing varying levels of phytogenic blends.

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, Ogun State, Nigeria. Located within

Latitude 70° 15' 59.66" N, Longitude 30° 26' 13.64" E. The climate was humid with a mean annual rainfall of 1037mm and mean temperature of 34.7 and 83% relative humidity, respectively (Google Earth 2023).

Experimental birds and Management

A total of 240 1-day-old Cobb 500 broiler chicks were used for this experiment. Birds were allotted on weight equalization basis into 6 dietary treatments of 40 birds each, replicated 5 times. The ***temperature*** of the brooding house was monitored with the aid of a thermometer. The birds were managed intensively with feed and water given without restriction. Standard broiler chicken vaccination programme was strictly adhered to without the use of antibiotics and anticoccidial drugs.

Sourcing and processing of test ingredient

Dried ginger rhizomes (*Zingiber officinale*) and black pepper seed (*Piper nigrum*) was purchased from a local market in Abeokuta. Ogun state, Nigeria. The sweet orange peel (*Citrus sinensis*) was collected from the orange sellers, fresh neem leaf (*Azadirachta indica*) and the lemon grass (*Cymbopogon citratus*) was obtained from the University Farm and air-dried for 7 days while the orange peel was sun-dried. The ingredients were milled separately into powder using kitchen blender. The blend was made by mixing 500g each of ginger, black pepper, sweet orange peel and 250g each of neem leaf and lemon grass according to the recommendation of past research works.

Experimental diets and design

A basal diet was formulated according to the recommendation of NRC (1994). The composition of the basal diet is presented in Table1. The experiment was arranged in a completely randomised design.

The phytogenic blend was added to the diet as follows:

T1 = Negative Control (Basal diet only); T2 = Basal diet + tetracycline (positive Control)

T3 = Basal diet + 5g blend/kg; T4 = Basal diet + 10g blend/kg

T5 = Basal diet +15g blend/kg; T6= Basal diet + 20g blend/kg

Table 1: The composition of the basal diet

Ingredients	Starter (day 0-21)
Maize	55.00
Soy bean meal	36.60
Fish meal (72%)	2.50
Limestone	1.00
Bone meal	2.00
Wheat offal	1.75
Common salt	0.25
Lysine	0.40
Methionine	0.25
*Broiler premix	0.25
Total (kg)	100.00
Analyzed nutrients	
ME (Kcal/kg)	2,827.44
CP%	26.60
CF %	4.89
Fat %	4.26

**Composition of Premix per kg of diet: vitamin A, 12,500 I.U vitamin E, 40mg; vitamin K_3 2mg; vitamin B_1, 3mg; vitamin B_2,5.5mg; niacin, 55mg; calcium pantothenate,11.5mg; vitamin B_6, 5mg; vitamin B_{12}, 0.025mg; chloride, 500; folic acid, 1mg; biotin, 0.08mg, manganese, 120; iron, 100mg; zinc, 80mg, copper 8.5mg; iodine, 1.5mg; cobalt, 0.3mg; selenium, 0.12mg; Anti- oxidant, 120mg.*

Determination of growth performance

Initial body weight (g/bird) was obtained before the commencement of the experiment. Weekly live body weight was measured. Average daily weight gain per bird was calculated as total final body weight minus total initial body weight divided by the number of birds in a replicate. The value was divided further by seven to obtain the average daily weight gain per bird/day. Daily feed intake (g) was obtained as the difference between quantity of feed given the previous day and the left over. The

figure was divided by the number of birds in a replicate. Feed conversion ratio (FCR) was calculated as the ratio of daily feed intake and daily weight gain.

Mortality is the total number of broiler chickens that died during the study. It was expressed in percentage (%) as; Mortality (%) = Number of dead broilers x 100

Total number of broilers

Economic Analysis

Economic analysis was carried out according to Ukachukwu and Anugwa (1995) as modified by (Ndelekwute *et al*., 2010). The parameters computed include; average cost/kg feed, feed cost/bird, feed cost/weight gain, revenue/bird and gross margin/bird.

Data Analysis

All generated data was subjected to Analysis of Variance (ANOVA) procedures appropriate for a completely randomized design (CRD) using SPSS 20 software package and the means of the parameters (P <0.05) was separated using Tukey.

RESULTS

As shown in table 2, birds in T1 recorded significant higher (P <0.05) final weight and weight gain which did not differ significantly from T2, T3, T4 and T5. The least value for these parameters was recorded for birds in T6. Treatment 3 recorded significantly higher (P <0.05) feed intake while the least values were recorded for T1 and T2. The best feed conversion ratio (FCR) was recorded for T1 which did not significantly differ (P >0.05) from T2, T3 and T4. The worst FCR was recorded for T6. Percentage mortality did not differ among treatment groups. Feed cost/kilogram (FC/Kg), Feed cost/bird, feed cost/weight gain (FC/WG) and feed cost differential (FCD) increased as the levels of the phytogenic blends significantly (P <0.05) increased in the diets. Revenue was significantly higher (P <0.05) in T1 which did not differ significantly from T3, T4 and T5. The gross margin was significantly (P <0.05) best for the negative control (T1) and worst for T6.

Table 2: Growth performance and economic analysis of starter broiler chickens fed diets with varying levels of phytogenic blend

Parameters	T1 (-ve control)	T2 +ve control	T3 5g/kg	T4 10g/kg	T5 15g/kg	T6 20g/kg	SEM	P-VALUE
IW(g/bird)	33.50	33.50	33.50	33.50	33.50	33.50	0.52	1.00
FW(g/bird)	560.00^{a}	511.50^{bc}	555.25^{ab}	537.50^{ab}	530.00^{ab}	482.50^{c}	6.66	0.00
Weight gain (g/bird)	526.50^{a}	478.50^{bc}	521.75^{ab}	504.00^{ab}	496.50^{ab}	449.00^{c}	6.66	0.00
Feed intake (g/bird)	1007.00^{c}	1003.00^{c}	1092.00^{a}	1050.75^{b}	1073.25^{ab}	1053.75^{b}	7.07	0.00
Feed conversion ratio	1.91^{c}	2.10^{bc}	2.09^{bc}	2.08^{bc}	2.17^{ab}	2.35^{a}	0.32	0.00
% Mortality	5.00	5.00	2.50	5.00	2.50	2.50	1.01	0.93
FC/Kg (₦)	400.00^{e}	500.00^{b}	432.00^{d}	464.00^{c}	495.00^{b}	527.00^{a}	8.99	0.00
FC/bird	403.00^{f}	501.50^{c}	471.50^{e}	487.25^{d}	531.75^{b}	555.00^{a}	10.14	0.00
FC/WG (₦)	765.25^{d}	1050.50^{b}	903.75^{c}	968.25^{bc}	1073.25^{b}	1238.50^{a}	31.94	0.00
Feed cost differential (₦)	0.00^{f}	100.00^{b}	32.00^{e}	64.00^{d}	95.00^{c}	127.00^{a}	8.99	0.00
Revenue (₦)	616.00^{a}	562.75^{bc}	610.75^{ab}	591.25^{ab}	583.00^{ab}	530.75^{c}	7.32	0.00
Gross margin (₦)	213.00^{a}	61.25^{d}	139.25^{b}	104.00^{c}	51.25^{d}	-24.25^{e}	16.14	0.00

^{abcdef} Mean in the same row with different superscript are different significantly (P< 0.05), SEM = Standard Error of mean, IW = Initial Weight,

FW = Final Weight, FC/Kg = Feed Cost/Kg, FC/bird = Feed cost/bird, FC/WG = Feed Cost/weight gain. Price/live

weight = ₦1100/kg

DISCUSSION

Significant higher final weight, weight gain and better feed conversion ratio recorded for birds fed basal diet only was not expected. This finding contradicts the report of Oso *et al.* (2019) which stated that body weight gain (BWG) and feed conversion ratio (FCR) improved with addition of 1%

phytogenic blend in the diet of broiler chickens. Also, Syed *et al*. (2021) reported improved BWG with starter broiler chickens fed with an Encapsulated Blend of a Phytogenic Feed Additive. The reasons for the results of this present study could be due to drug failure on the part of the oxytetracycline (OTC) which occasion from drug-ion complex formation between the drug and bivalent ions in the feed (Chopra and Roberts, 2001). Maddaleno *et al*. (2021) opined that intestinal absorption of oxytetracycline might be altered if it is administered along with feed, substances that increase stomach pH or contain bivalent or trivalent cations which may trigger the development of chelating complexes. It has been reported (Schmitt and Schneider 2000, Jin *et al*. 2007) that OTC bind divalent ions and form non-absorbable chelates affecting drug absorption from gastrointestinal tract (GIT). The birds had unrestricted access to feed and water, Ziółkowski *et al*. (2016) suggested a negative correlation between divalent ion concentration in water and bioavailability of orally administered OTC. On the other hand, the non-significance difference among the treatments with phytogenic blend (PB) up to 15g/kg and those fed basal diet only could be as a result of toxicity in the birds caused by the phytogenic blend which delayed growth. Gabriela *et al*. (2021) reported lower body weight at seven days in broiler chickens fed diet with phytogenic blend. Estimated revenue per bird was statistically similar for the birds on basal diet only and those on PB up to 15g/kg. However, the gross margin from birds on basal diet only was the best. This was due to high cost of the PB which arises from the cost of black pepper.

CONCLUSION

The result of this present study indicated that supplementing starter broiler chicken diets with this PB improved weight gain and could be use at 15g/kg in replacement for antibiotics.

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