

EFFECT OF GARLIC (*Allium sativum*) SUPPLEMENT ON GROWTH PERFORMANCE AND COST OF FEEDING OF BROILER CHICKENS.

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ABSTRACT

The experiment was conducted at the Poultry Production Unit, of Ibrahim Badamasi Babangida University Lapai, Niger State to investigate the growth performance and economics of production of broiler chickens fed with different levels of garlic powder inclusion. Four experimental diets were formulated. The treatments were diets with garlic supplement at 0g (control), 10g (T2), 15g (T3), and 20g (T4) coded as diets 1, 2, 3, and 4 respectively for both starter (23%CP) and finisher (20%CP) rations. One-hundred and twenty (120) day old broiler unsexed 'Marshal' chicks were randomly allotted to the dietary treatments with three replications of 30 birds per treatment each in a completely randomized design (CRD). Feed and water were supplied ad libitum and experiment lasted for a period of eight weeks. Data collected was subjected to analysis of variance (ANOVA) according to the procedures of Steel and Torrie (1980). Results showed that daily feed intake (0.53, 0.49, 0.45, 0.45g); weekly weight gain (0.12, 0.13, 0.13, 0.13g), final body weight gain (0.90, 1.02, 1.03, 1.06kg,) and feed conversion ratio (0.24, 0.27, 0.29, 0.30) were not significantly affected by the dietary level of garlic. With respect to daily feed intake, daily weight gain and feed conversion ratio were not significantly different across the treatments. Based on the result obtained from this trial, broiler birds that were fed with 20g/kg of garlic supplemented diet had the best performance in terms of final body weight gain (1060.00g/kg) and percentage mortality (3.33 %). However, it is not economical because of the high cost of garlic. Therefore, the formulation could be recommended for further evaluation in the dietary of broiler chickens.

Keywords: *Garlic, Broiler Chickens, Supplement, Performance, Cost*

INTRODUCTION

In recent years, human needs for quality animal protein has become a national and international issue that needed mindful and urgent attention.

This is because nutritional status of the population and economic developments are interlinked. Production of broiler chickens is one way of meeting the animal protein requirement of the Nigeria populace. Odunsi (2003) reported that the rapid growth of human and livestock population is creating an increase in the needs for food and feed in less developed countries. Lee (2001) reported that most domestic animals are fed with synthetic compound purposely to achieve either medication or growth improvement so as to meet the animal protein requirement of the populace. The ban on the use of antimicrobial growth promoter coupled with the reduction in the use of synthetic growth promoter by the farmers European Union (2006), has made farmers to look for alternative feed growth promoter in poultry feed Al-Harathi, (2002). Furthermore, the prohibition of the use of antibiotics as a dietary feed supplements necessitate the use of non-conventional supplements in poultry production (Tipu *et al.*, 2006; Puvaca *et al.*, 2013). Garlic has been a traditional treatment in many countries, notably the Near East, China, and India. It has attracted particular attention of modern medicine because of its widespread use around the world and the cherished belief that it helps to maintain good health by warding off illnesses and providing more vigor (Mikaili *et al* 2013).

The importance of garlic in recent years as growth promoter, has been increasingly used as a supplement in nutrition and protection of farm animals (pigs, poultry, cattle, sheep), garlic action is manifested in a reduced-expanding range of pathogenic micro-organisms in the digestive tract, which resulted in the rapid growth of poultry, efficient digestion, increased immunity and health of poultry (Kumar *et al.*, 2010). The growth promoters like chemical products, herbal plants, essential oils, antibiotics, enzymes etc. play an active role in the experimental and commercial production of large and small animals (Ashour *et al.*, 2014). *In vitro* studies have shown that garlic possesses antibacterial, antifungal, antiparasitic, antiviral and antioxidant properties (Castanon, 2007). Garlic (*Allium sativum*) has been a subject of considerable interest as a medicinal and therapeutic agent worldwide since ancient times (Shetty *et al.*, 2013). It is against this background that garlic powder (GP) at 0, 10g, 15g, 20g were used to evaluate the performance and estimate the cost of feeding broiler chickens in the humid tropics of Nigeria.

MATERIALS AND METHODS

Location of the experimental site: The research was conducted at the Teaching and Research Farm of the Ibrahim Badamasi Babangida University, Lapai, Niger state, Nigeria.

Sources of Test Ingredients, Experimental Animals and Their Management: The day-old chicks were purchased from reputable supplier (Biodun) in Minna, Niger State. Garlic bulbs (*Allium sativum*) were purchased from the ultramodern market Minna, Niger State, Nigeria. The garlic bulbs were separated into cloves, chop into chips and sun-dried. The dried garlic chips were milled and analysed. While maize, fish meal, groundnut cake, wheat offal, bone meal, salt, methionine, lysine and vitamin-mineral premix (vmp) were also bought from Kure ultramodern market Minna, Niger State. One hundred and twenty (120) *marshal* broiler chicks were used for this experiment and the chicks were allotted randomly into four (4) treatments in a completely randomized design (CRD). Each treatment had three replicates with ten (10) chicks per replicate (mixed sexes). Prior to the arrival of the birds, the pen for the experiment was washed and fully disinfected and housed intensively. The brooding room was heated before the arrival of the birds to a temperature of 35°C and reduced by 3°C per week until 21°C was accomplished. The birds were immediately placed on the experimental diet. The chicks were brooded on deep litter using charcoal pot as the source of heat and chargeable lamps were used as a source of lighting. The bedding materials used for the first few weeks (1-3) were cartons which were spread on the floor.

This was done to prevent injury to the soft legs as well as to accustom the chicks to their new environment before wood shaving was introduced. The pens were equipped with feeders and drinkers. Litters were changed bi-weekly. The chicks were acclimatized for five days. water was served *ad libitum* throughout the experimental period. Three (3) different medications were administered. In the first week, gomboro was administered orally against infectious bursal disease, in the second week Lasota orally against Newcastle disease and Gomboro second dosage was administered at the fourth week orally against infectious bursal disease and multivitamin soluble powder (Vitalyte) were given as an anti-stress and these were bought from step by step veterinary drugs store Minna, Niger state. The experiment lasted for eight weeks

Data collection: Data on growth (initial growth, final weight, daily weight gain, total concentrate intake, total feed intake, feed conversion ratio) and other performance parameters were collected over a period of eight (8) weeks using a Camry weighing scale for weekly weighing of the animals. Feed intake was determined on daily basis by finding the difference between the feed served to the animal and left over quantities. The difference in weight between the two gave the quantity of feed consumed per day. Mean daily weight gain and feed conversion ratio were also determined. Below are the formulas for calculating growth parameters

Feed intake = feed offered (g) – left over (g).

Weight gain = final weight(g) – initial weight(g).

Feed conversion ratio (FCR) = $\frac{\text{feed consumed(g)}}{\text{Weight gain (g)}}$

Mean daily gain = $\frac{\text{mean final weight gain}}{\text{number of days}}$

Mean daily feed intake = $\frac{\text{mean total feed intake}}{\text{number of days}}$

Mortality (%)= $\frac{\text{number of dead birds}}{\text{initial number of the birds}} \times 100$

All the feed ingredients acquired and processing activities involved were monetized and price per kg of each ingredient will be determined for economic analysis. Veterinary care and miscellaneous (variable cost); this will be calculated as the total amount of money spent on vaccines, drugs, day old chick and other expenses divide by the number of rabbits. Average body weight (kg); this will be the final body weight of chickens before slaughtering. Price per feed; this be calculated by taking into consideration of individual ingredients to be used in compounding the diet. This will be calculated by; price per (kg) feed= cost per kg of diet. Total investment; this will be total amount of the money spent during the course cost of production. Gross returns: this will be life weight gain multiply by the price of rabbit per kg. gross profit: this will be the amount realized after the sales of the rabbits. It is given as gross return- total investment.

Economic Analysis

Key

Cost of feed/Kg/N= Cost of feed ingredient

Total feed intake per rabbit (g) = Total feed intake

Total cost of feed intake/rabbit (N/g) = Cost of feed ingredient X Total feed intake

Total weight gain= final weight gain

Cost of feed intake/ (N) Weight gain (g) = Cost of feed intake/Total weight gain

Cost of feed intake/Total weight gain X 1000 = g to Kg

Price of bird + variable + cost of feed = Total investment

Live weight gain X price of rabbit per Kg = Gross return

Gross return – total investment = Gross profit

Ratio of the gross profit / total investment = Benefit cost ratio

Experimental Diets: The diets formulated were designated T1-T4 and had the test ingredients garlic powdered incorporated into the diet at the level of 0, 10g, 15g, and 20g/kg inclusion for the experiments. The feed ingredients in the formulated diets consisted of maize, fish meal, groundnut cake, wheat offal, bone meal, salt, methionine, lysine and vitamin mineral premix(vmp). All the feed ingredients were ground in hammer mill, and mixed before being fed to the birds. The diets were formulated to give 23% and 20% crude protein needed for the starter as well as the finisher level of bird growth respectively.

Table 1: Composition of the starter diet

Ingredients (%)	T1	T2	T3	T4
Maize	54.40	54.40	54.40	54.40
Wheat offal	5.00	5.00	5.00	5.00
Fishmeal	5.00	5.00	5.00	5.00
Groundnut cake	32.00	32.00	32.00	32.00
Bone meal	0.50	0.50	0.50	0.50
limestone	2.00	2.00	2.00	2.00
Salt	0.50	0.50	0.50	0.50
Premix*	0.30	0.30	0.30	0.30
Lysine (%)	0.15	0.15	0.15	0.15
Methionine (%)	0.15	0.15	0.15	0.15
Garlic (g/kg of feed)	0.00	10.00	15.00	20.00
Total	100.00	100.00	100.00	100.00
Calculated values				
ME Kcal/kg	2877.37	2877.37	2877.37	2877.37
Crude Protein (%)	23.10	23.10	23.10	23.10

*Provided per kilogram of diet: vitamin A, 10000IU (retinyl acetate); cholecalciferol, 3000IU; vitamin E, 8.0IU (DL-a-tocopheryl acetate); K, 2.0mg; thiamine, 2.0mg; pyridoxine, 1.2mg; cyanocobalamin, 0.12mg; niacin, 1.0mg; pantothenic acid, 7.0mg; folic acid, 0.6mg; choline chloride, 500mg; Fe, 60mg; Cu, 8.0mg; Zn, 50mg; CO 0.45mg; I, 2.0mg; Se, 0.1mg. ME= Metabolizable energy.

Table 2: Composition of the finisher diet

Ingredients (%)	T1	T2	T3	T4
Maize	57.40	57.40	57.40	57.40
Wheat offal	6.00	6.00	6.00	6.00
Fishmeal	4.00	4.00	4.00	4.00
Groundnut cake	29.40	29.40	29.40	29.40
Bone meal	0.50	0.50	0.50	0.50
Limestone	2.00	2.00	2.00	2.00
Salt	0.25	0.25	0.25	0.25
Premix*	0.25	0.25	0.25	0.25
Lysine (%)	0.10	0.10	0.10	0.10
Methionine (%)	0.10	0.10	0.10	0.10
Total	100.00	100.00	100.00	100.00
Garlic (g/kg of feed)	0.00	10.00	15.00	20.00
Calculated values				
ME Kcal/kg	2877.37	2877.37	2877.37	2877.37
Crude Protein (%)	20.62	20.62	20.62	20.62

*Provided per kilogram of diet: vitamin A, 10000IU (retinyl acetate); cholecalciferol, 3000IU; vitamin E, 8.0IU (DL-a-tocopheryl acetate); K, 2.0mg; thiamine, 2.0mg; pyridoxine, 1.2mg; cyanocobalamin, 0.12mg; niacin, 1.0mg; pantothenic acid, 7.0mg; folic acid, 0.6mg; choline chloride, 500mg; Fe, 60mg; Cu, 8.0mg; Zn, 50mg; CO 0.45mg; I, 2.0mg; Se, 0.1mg. ME= Metabolizable energy.

Data Analysis: Data generated from the study were subjected to analysis of variance (ANOVA) using statistical package (SAS, 2002). The variations in means were separated using the Duncans Multiple Range Test (Duncan, 1955).

Test ingredients and dietary preparation:

Test ingredients garlic powdered incorporated into the diet at the level of 0, 10g, 15g, and 20g/kg inclusion levels for the experiments. The composition of the experimental diets is shown in Table 1 and 2

Proximate Analysis:

The dried garlic chips were milled and analyzed for chemical and proximate composition as described in AOAC (2000) Method.

Data analysis

Data collected were subjected to analysis of variance (ANOVA) according to the procedures of Steel and Torrie (1980).

RESULTS AND DISCUSSION

The results of performance of chicken fed with garlic powdered as a supplement (Table 3) showed that there were no significant ($p < 0.05$) differences in the parameters measured (final weight gain, feed intake, body weight gained and feed conversion ratio). However, a numerical higher values of final weight gained (1060.00g) body weight gained (0.13) and feed conversion ratio (0.30) were obtained at 20g/kg garlic supplement. This finding is similar to the work of Pourali *et al.* (2010) who suggested that allicin in garlic promotes performance of the intestinal flora thereby enhancing the utilization of energy, leading to improved growth. However, it did not confirm the findings of Demir *et al.*, 2003; Ademola *et al.*, 2005) who fed herbal plants (garlic) as a supplement in broiler diets and observed a pronounced improvement in their body weight gain and feed conversion ratio. An active component of garlic could therefore exert different effect on the test animals if the garlic was processed differently

Table 4 Shows the results for Cost benefit for chickens fed garlic powdered as a supplement. The results showed that T4 (N851.2) had the highest gross return followed by T3 (N820.8), T2 (N 817.6) and T1 (N 794.4) respectively. However positive gross profit was recorded in T1 (N 9.18) while negative gross profit was recorded in T2 (N -48.23N), T3 (N -86.13N), and T4 (N -95.23N). This finding is not in line with the result of (Raeesi *et al.*, 2010) who reported that raising birds on diet containing garlic as a supplement is not profitable.

Table 3: Performance characteristics of broiler chickens fed test ingredient

Parameter	GP 0g	GP10g/kg	GP15g/kg	GP20g/kg	SEM	LSD
Initial Body Gain (Kg)	0.04	0.04	0.03	0.04	0.00	NS
Final Body Gain (Kg)	0.99	1.02	1.03	1.07	0.12	NS
Weekly Body Weight Gain	0.12	0.13	0.13	0.13	0.01	NS
Feed intake	0.53	0.49	0.45	0.45	0.04	NS
Feed conversation ratio	0.24	0.27	0.29	0.30	0.04	NS
Mortality	22%	20%	10%	3.3%		

*Means with the same superscript (s) in the same row are not significantly ($p>0.05$) difference SEM = standard mean error, LSD = Level of significant difference, NS = Not Significance, GP 0 = Contained diet without inclusion of garlic powered, GP 10g/kg = Contained garlic powered 10g, GP 15g/kg = Contained garlic powered 15g, GP 20g/kg = Contained garlic powered 20g.

Table 4: Cost benefit for chickens fed garlic powder as a supplement

Parameters	GP 0g	GP 10g/kg	GP 15g/kg	GP 20g/kg
Cost of day old chicks (N)	360.00	360.00	360.00	360.00
Final Weight Gain (Kg)	0.99	1.02	1.03	1.06
Cost of Feed(N/Kg)	125.23	205.83	246.13	286.43
Total Cost of feed consumed (N)	526.82	827.00	878.91	1025.67
Total Feed Consumed	4.21	4.02	3.57	3.58
Variable Cost (N)	300.00	300.00	300.00	300.00
Total investment (N)	785.23	865.83	906.13	946.43
Cost of bird/Kg	800.00	800.00	800.00	800.00
Gross return (N)	794.4	817.6	820.8	851.2
Gross Profit(N)	9.18	-48.23	-86.13	-95.23
Cost benefit ratio (N)	0.012	-0.056	-0.095	0.101

GP 0 = Contained diet without inclusion of garlic powder, GP 10g/kg = Contained garlic powder 10g, GP 15g/kg = Contained garlic powder 15g, GP 20g/kg = Contained garlic powder 20g.

CONCLUSIONS

Based on the result obtained from this trial, broiler birds that were fed with 20g/kg of garlic supplemented diets had the optimum performance in terms of high final body weight gain (1060.00g/kg), with lower percentage of mortality. However, it is not economical in terms of cost of production.

RECOMMENDATIONS

Based on the conclusion drawn from this study, the 20g/kg garlic powder level of inclusion can be recommended for further study in the diet formulation for broiler birds.

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