



EFFECT OF GARLIC (*Allium sativum*) SUPPLEMENTATION ON GROWTH PERFORMANCE AND CARCASS CHARACTERISTICS OF BROILER CHICKENS

Ibrahim, H¹., ¹Aliyu, Z., ¹Oluwawuni, T.B., ¹Awolola, G. and ²Abdulmalik, S.U.

¹Department of Animal Production, Faculty of Agriculture, Ibrahim Badamasi Babangida University, Lapai, Niger State, Nigeria.

²Department of Microbiology, Federal University of Technology, Minna, Niger State, Nigeria

Corresponding Author: ihadiza080@gmail.com/GSM No- 08036101761

ABSTRACT

The study was conducted to investigate the effect of garlic supplementation on the growth performance and carcass characteristics of broiler chickens. One hundred and twenty (120) day old chicks of mixed sexes were randomly allotted into four treatment groups, thirty birds per treatment and were replicated three times with ten birds per replicate in a complete randomized design. Four test diets were formulated and designated as T1 for control, while T 2, 3, and 4 with inclusion levels of garlic powder at 0g/kg, 20g/kg, 15g/kg and 10g/kg respectively. The study lasted for eight weeks. The parameters investigated were growth performance (initial weight, final weight, weekly body weight gain, percent dressed weight, feed intake (kg), feed conversion ratio, and mortality) and carcass characteristics. Cut-up parts of broiler chickens (head, neck, wings, drumsticks, thigh chest, back, shank) and visceral organs (heart liver, kidney, spleen , pancreas, gizzard, abdominal fat, proventriculus and intestine). Data generated were subjected to analysis of variance and significant differences were separated using Least Significant Difference. The results of growth performance showed that there were no significant ($P>0.05$) differences in the parameters measured, except percentage dressed weight that showed significant difference with T1 having a higher value of (64.33%) which was closely followed by T4 with 62.60 %, T2 with 61.10 % and the least value was T3 with 54.53 %. The result of the study showed that garlic powder had no significant effect on body weight gain, carcass characteristics and feed conversion ratio.

KEYWORDS: Supplements, Chickens, Carcass Characteristics, Garlic

INTRODUCTION

Poultry production has obvious advantages over other livestock species, thus implying that it can efficiently solve the problem of animal protein shortage in most of the developing countries like Nigeria (Olabanji *et al.* 2009). Poultry industry in Nigeria occupies a prominent position as a major source of animal protein supply to the citizen. Over the years, growth of the poultry industry has followed a pattern closely dictated by the economic fortunes of the countries. USDA (2013) reported that commercial poultry production in Nigeria was estimated at about USD 800 million. Poultry sector contributed about 25% of the agricultural domestic products of the Nigerian economy (FAO, 2009). USDA (2013) currently rated Nigeria as the leading country in Africa with respect to egg production, but fourth in broiler production. This report indicated that Nigeria has to improve on her production with respect to broiler birds. Poultry production is gaining popularity in the developing countries due to its role in bridging the gap in protein malnutrition while providing for economic empowerment of the resource poor segment of the society (Weeks *et al.*, 2002). Garlic (*Allium sativum* L.) is bulbous vegetable, well known spice and medicinal plant, which belongs to the family Liliaceae

and genus *Allium* (Simon and Jenderek, 2003). It is increasingly being used as an additive in nutrition and protection of farm animals (pigs, poultry, cattle, sheep), and their 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 (Kumar *et al.*, 2010). The most important health benefits of garlic powder include its ability to regulate high blood pressure, lower overall cholesterol levels, improve the immune system, reduce the risk of certain cancers, and aid in digestion, among others (USDA, 2013).The objectives of the presents study, therefore was to determine the effects of garlic supplement on growth performance and carcass parameter of broiler chickens.

MATERIALS AND METHODS

Location of experimental site:

The research was conducted at the Teaching and Research Farm of Ibrahim Badamasi Babangida University, Lapai, Niger state, Nigeria. Lapai lies between latitude 9° 31 and 9° 45, each of the equators. The area falls within the Southern Guinea Savannah Vegetation Zone of Nigeria with mean rainfall ranges

between 1100-1600mm and mean temperature 21°C and 36.5°C.

Source and processing of the test ingredient (garlic):

Garlic bulbs (*Allium sativum*) were purchased from ultra-modern market at Minna, Niger State, Nigeria. The fresh garlic bulbs was peeled and washed to remove adhering debris and cut/sliced into small sizes after which they were sun dried for three weeks, the dried garlic was grounded into powdery form, and then added to the starter and finisher diets for the chickens.

Source and management of experimental chickens:

One hundred and twenty (120) mixed sex day-old broiler chicks were bought from Karmadex Nigeria Plc, located in Ibadan, Nigeria and were used for the experiment. They were allotted into four treatments of three replicates with each replicate containing 10 birds assigned in a completely randomized design. The birds were placed on the experimental diets on their arrival. The chicks were brooded on deep litter and heat was supplied during brooding stage using charcoal pot and kerosene lanterns as sources of light. The birds were vaccinated against endemic diseases in the area, the method of vaccination adopted was via drinking water and it was carried out effectively. Feed and water were supplied *ad libitum*. Feed intake, body weight and mortality of the birds were recorded on weekly basis.

Data on body weight gain and feed intake was collected on weekly basis. However, the feed intake was monitored by finding the differences between the served and left over quantities. The mean value of these parameters was obtained and recorded. The data were further used to obtain the following:

- Mean weight gain = Mean final weight(g) – mean initial weight(g)
- Mean weekly gain = $\frac{\text{mean final weight gain}}{\text{Number of weeks}}$

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

feed conversion ratio = $\frac{\text{mean of feed intake}}{\text{Mean of weight gain by birds}}$

$Mortality (\%) = \frac{\text{Number of dead birds}}{\text{Initial no of the birds}} \times 100$

Experimental Diets:

Broiler rations were formulated and fed as control diet containing 0g/kg of garlic while diets 2, 3 and 4 had 20g/kg, 15g/kg and 10g/kg of garlic powder respectively (Table 1 and 2). The feed ingredients in the formulated diets consisted of maize, groundnut cake, wheat offal, bone meal, fish meal, limestone, lysine, methionine, salt and vitamin/mineral premix.

Table 1: Composition of experimental broiler starter diet

Ingredients (%)	T1	T2	T3	T4
Maize	54.40	54.40	54.40	54.40
Groundnut	32.00	32.00	32.00	32.00
Wheat Offal	5.00	5.00	5.00	5.00
Fish Meal	5.00	5.00	5.00	5.00
Bone Meal	0.50	0.50	0.50	0.50
Premix	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
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)	0.00	20.00	15.00	10.00
CALCULATED VALUES				
Crude Protein	23.10	23.10	23.10	23.10
ME (Kcal/kg)	2877.37	2877.37	2877.37	2877.37
Fibre content	3.25	3.25	3.25	3.25

Key: ME =Metabolizable Energy, T1 = contained only feed ingredient without garlic powder (Control), T2 = contained feed ingredient with 20g/kg of garlic powder, T3 = contained feed ingredient with 15g/kg of garlic powder, T4 = contained feed ingredient with 10g/kg of garlic powder. 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.

Table 2: Composition of experimental broiler finisher diets

Ingredients (%)	T1	T2	T3	T4
Maize	54.40	54.40	54.40	54.40
Groundnut	28.40	28.40	28.40	28.40
Wheat Offal	10.50	10.50	10.50	10.50
Fish Meal	3.00	3.00	3.00	3.00
Bone Meal	2.00	2.00	2.00	2.00
Premix	0.25	0.25	0.25	0.25
Limestone	1.00	1.00	1.00	1.00
Salt	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 powder (kg)	0.00	20.00	15.00	10.00
CALCULATED VALUES				
Crude protein	20.26	20.26	20.26	20.26
ME (Kcal/kg)	2917.04	2917.04	2917.04	2917.04
Fibre content	3.65	3.64	3.64	3.64

Key:ME =Metabolizable Energy, T1 = contained only feed ingredient without garlic powder (Control), T2 = contained feed ingredient with 20g/kg of garlic powder, T3 = contained feed ingredient with 15g/kg of garlic powder, T4 = contained feed ingredient with 10g/kg of garlic powder. 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, zzz2.0mg; Se, 0.1mg.

Evaluation of carcass characteristics of the chickens

Carcass characteristic was carried out at the end of the experiment. Three birds per replicates were randomly selected, slaughtered and dressed with hot water (scalding). After dressing, the visceral organs and the cut-up parts were weighed in grams and expressed as percentage of live weight.

Statistical analysis:

All data obtained from the experiment were subjected to Analysis of Variance (ANOVA) according to the procedure of Gen Stat, (2014).

RESULTS AND DISCUSSION

Growth performance of broiler chickens fed garlic based diets

The result from proximate composition analyses of garlic power showed that garlic powder was found to be rich in carbohydrate (73.22) but low in crude fat (0.72), the crude protein of garlic powder was (15.33) while crude fibre (2.01), also moisture content of garlic powder was (4.55) and Ash (4.08)

Table 3 shows the effect of garlic supplementation on growth performance and carcass characteristics of

broiler chickens fed garlic based diets. The results showed that chickens fed diets containing garlic powder supplementation showed no significant (P>0.05) difference in body weight compared to those in the control group. This could be attributed to the presence of anti-nutritional component in the garlic. This findings corresponded with the reports of Chol *et al.* (2010); Fadlalla *et al.* (2010) and Otunola *et al.* (2010) they stated that garlic contained up to 4.6% saponin and 1.2% flavonoid in dry matter, which is one of the factors causing the depressive effect on production performance of broilers. As such, the findings of Raesi *et al.* (2010), and Stanacev *et al.* (2011) that stated that it would be better to use garlic as growth stimulator periodically than continuously should be consider.

The results of feed conversion ratio revealed that there were no significant difference between the treatments. Mortality occurred in all treatments, with the highest mortality occurred among chickens in the control group, while the least was observed in chickens fed 20g/kg garlic based diet. This supported the report of Rahanatnejad *et al.* (2009). , who recorded a significant improvement in mortality and

feed conversion ratio of broilers fed with garlic supplementation

Table 3: Performance of broiler chickens fed garlic based diets

Parameter	T1	T2	T3	T4	SEM	LSD
Initial weight (g)	37.00	36.00	34.00	38.00	0.002	NS
Final Body weight (g)	1030.00	1100.00	1060.00	1060.00	0.12	NS
Weekly body weight gain (g)	120.00	130.00	130.00	130.00	0.01	NS
Intake (g)	530.00	450.00	450.00	490.00	0.04	NS
FCR	0.24	0.30	0.29	0.27	0.04	NS
Mortality (%)	22	3.3	10	20		

Means in the same row with different letters in superscript are significantly different ($P < 0.05$) Mean \pm Standard deviation, FCR = Feed Conversion Ratio, SEM =Standard Error Mean, LSD = Level of Significant Difference

Carcass Characteristics of Broiler Chickens fed Garlic based diets

Carcass characteristics of broiler finisher chickens expressed as percentage live weight is presented in Tables 4 and 5. The weights of liver, kidney, heart, spleen, pancreas, gizzard and proventriculus were not significantly ($P > 0.05$) affected by dietary supplementations of garlic powder. However, abdominal fat and intestinal length showed significant ($P < 0.05$) difference. T3 recorded the highest performance in gizzard and intestine. The effect of garlic on increase of mass of internal organs is explained by Otunola *et al.* (2010) who has claimed that the consequences of adverse effect of garlic derive from its chemical composition. Chickens in T2 which were fed diet containing 20 g/kg garlic supplementation, had significantly ($P < 0.05$) higher abdominal fat compared

to others, this supported the findings 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..

Drumstick, thigh, head, neck, chest and shank showed no significant difference between the treatments. Stanacev *et al.* (2010) and Raeesi *et al.* (2010) also reported no significant effect of garlic on carcass cut weights, the weights of back and wing showed significant differences across treatments. However, higher values were recorded in control treatment group for back and wing which is in agreement with most of studies by Stanacev *et al.* (2010), Abdullah *et al.* (2010) and Slyranda *et al.* (2011), but on the other hand, differences were not observed on carcass yield rather positive effects in their results were reported by Rahmatnejad *et al.* (2009), Raeesi *et al.* (2010).

Table 4: Visceral organs of broiler chickens fed garlic based diets

Visceral organ (g)	T1	T2	T3	T4	SEM	LSD
Liver	31.67	24.83	24.33	31.67	5.88	NS
Kidney	9.50	8.10	5.83	8.10	1.55	NS
Heart	7.33	6.67	6.17	7.17	1.01	NS
Spleen	1.25	0.82	0.42	0.42	0.57	NS
Pancreas	3.00	3.50	3.17	2.50	0.57	NS
Gizzard	40.50	35.67	40.83	39.17	4.49	NS
Abdominal fat	2.83 ^b	4.25 ^a	1.50 ^d	2.25 ^c	0.94	*
Proventriculus	7.83	7.50	8.10	9.00	1.38	NS
Intestine (g)	111.17 ^b	104.33 ^d	146.00 ^a	108.67 ^c	14.18	*

Means in the same row with different letters in superscript are significantly different ($P < 0.05$) Mean \pm Standard deviation, SEM =Standard Error Mean, LSD = Level of Significant Difference

Table 5: Cut-up parts of broiler chickens fed garlic supplement

Cut-up Parts (g)	T1	T2	T3	T4	SEMLSD	
Dressed weight (kg)	0.83	0.66	0.67	0.73	0.93	NS
% dressed weight	64.33 ^a	61.10 ^c	54.53 ^d	62.60 ^b	3.31	*
Head	43.17	37.00	36.67	38.33	3.00	NS
Neck	51.67	40.33	42.33	47.83	4.60	NS
Wings	98.00 ^a	81.81 ^d	91.00 ^b	86.33 ^c	6.38	*
Drumsticks	123.00	100.67	101.83	110.67	22.33	NS
Thigh	141.50	114.83	117.33	117.00	14.91	NS
Chest	193.16	161.00	170.83	175.33	22.70	NS
Back	170.67 ^a	133.83 ^c	126.83 ^d	147.67 ^b	13.88	*
Shank	55.17	49.50	51.59	52.50	5.46	NS

Means in the same row with different letters in superscript are significantly different ($P < 0.05$) Mean \pm Standard deviation, SEM = Standard Error Mean, LSD = Level of Significant Difference

CONCLUSION AND RECOMMENDATION

It can be concluded from the result that garlic supplementation in broiler diets had limited positive effect on growth performance. It is glaring from the results obtained from this experiment that the garlic powder as feed supplement to the broiler diets significant differences were amongst all the dietary treatments, but the result observed that T2 (20g/kg) had the least average feed intake.

Based on the conclusion drawn from this study, the 20g/kg (T2) garlic powder level of inclusion can be recommended for further study in the diet formulation for broiler birds.

REFERENCES

Abdullah, A., K. Mahmoud, B. Nusairat, R. Qudsieh, (2010): Small intestinal histology, production parameters, and meat quality as influenced by dietary supplementation of garlic (*Allium sativum*) in broiler chicks. *Italian Journal of Animal Science* 9, 11-15.

Choi I. H., Park W. P., Kim Y. J. (2010): Effects of dietary garlic powder and α -tocopherol supplementation on performance, serum cholesterol levels, and meat quality of chicken. *Poultry Journal of Science* 89, 1724-1731

Fadlalla, I.M.T., B.H. Mohammed, A.O. Bakhiet, (2010): Effect of Feeding Garlic on the Performance and Immunity of Broilers. *Asian Journal of Poultry Science* 4, 182-189.

FAO (2009): Food and Agriculture Organization of the United Nation. Statistic Division. Garlic production crop/world region/production Quantity. © *FAO Statistics Division*

Gen Stat Release (2014): VSN Intenation Ltd. Rothamsted Experimental Station. De. 10.3

Kumar, S., K.C. Sharadamma, P.M. Radhakrishna, (2010): Effects of a Garlic Active Based Growth Promoter on Growth Performance and Specific Pathogenic Intestinal Microbial Counts of Broiler Chicks. *International Journal of Poultry Science* 9, 244-246.

Olabanji, R. O., Farinu, G.O., Akinlade, J.A., Olabiyi O.O., Odinsi A.A., Akingbade, A.A. (2009). Studies on haematological and serum biochemical characteristics of broilers fed different levels of wild sunflower (*Tithoniadiversifolia*) leave blood meal mixture. *International Journal of Agriculture apiculture Research*.

Otunola, G.A., O.B. Oloyede, A.T. Oladiji, A.J. Afolayan, (2010): Comparative analysis of the chemical composition of three spices – Allium

- sativum L. ZingiberofficinaleRosc. And Capsicum frutescens L. commonly consumed in Nigeria. *African Journal of Biotechnology* 9, 6927-6931.
- Raeesi, M., S.A. Hoseini-Alibad, A.A. Roofchae, Z. Shahneh, S. Pirali, (2010): Effect of Periodically Use of Garlic (Alliumsativum) Powder on Performance and Carcass Characteristics in Broiler Chickens. *World Academy journal of Science, Engineering and Technology* 68, 1213-1219.
- Rahmatnejad, E., H. Roshanfekar, O. Ashayerizadeh, M. Mamooee, A. Ashayerizadeh, (2009): evaluation the effect of several non-antibiotic additives on growth performance of broiler chickens. *Journal of Animal and Veterinary Advances* 8, 1670-1673.
- Simon, P.W., M.M. Jenderek, 2003: Flowering, Seed Production, and the Genesis of Garlic Breeding. *Plant Breeding Reviews* 23, 211-244.
- Stanačev, V., N. Milošević, S. Kovčun, N. Plavša, S. Bjedov, V. Stanačev, 2010: Effect of different garlic levels in broiler chicken food on production parameters. *Contemporary Agriculture* 59, 86-91
- Stanačev, V., D. Glamočić, N. Milošević, N. Puvača, V. Stanačev, N. Plavša, (2011): Effect of garlic (alliumsativum l.) in fattening chicks Nutrition. *African Journal of Agricultural Research* 6, 943-948.
- Suriya, R., I. Zulkifli, A.R. Alimon, (2012): The Effect of Dietary Inclusion of Herbs as growth Promoter in Broiler Chickens. *Journal of Animal and Veterinary Advances* 11, 346-350.
- USDA 2013 Organic information service pvt Ltd.
- Weeks C.A., C.J. Nicol, C.M. Sherwin, and S.C. Kestin, (2002): Comparison of the behaviour of broiler chickens in indoor and free-range environments. *Anim. Welf.*, 3: 179-192