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EFFECT OF VARYING LEVELS OF DIETARYGARLIC (*Allium sativum* L.) SUPPLEMENTATION ON SERUM ANTIOXIDANT ACTIVITY AND ECONOMIC BENEFIT OF BROILER CHICKENS

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Abstract
An experiment was conducted to determine the effect of diets containing varying levels of garlic on serum antioxidant activity and economic benefit of broiler chickens. One hundred and twenty (120) broiler finisher chickens were randomly distributed into four treatment groups each replicated thrice with 10 chicks per replicate in a completely randomized design. Garlic was supplemented at different levels designated as follow: T_1: control diet (0.0% garlic), T_2: diet supplemented with 1.0% garlic, T_3: diet supplemented with 1.5% garlic and T_4 diet supplemented with 2.0% garlic. Serum antioxidant activity and economic benefit were determined post finisher phase. Final weights and weight gains increased by 16.64 and 28.46 % respectively at 2.0 % level of garlic supplementation. Chickens fed 2.0 % garlic-based diet had the highest feed intake 4.95kg which was higher than others by 9.09 % while feed cost per gain increased by ₦250.75 (16.67%) in chickens fed 1.0% garlic-based diet. Lipid peroxidation declined while antioxidant enzymes significantly ($P<0.05$) increased with higher levels of garlic supplementation in the diets. Cost benefit analysis showed that feeding broiler chickens with garlic-based diets increased total feed intake and total weight gain by 7.07 and 17.23% respectively. The varied levels of garlic supplementation did not remarkably improve performance parameters in broiler chickens but it showed anti-oxidative potentials up to the highest level of garlic supplementation. The study concluded that garlic can be supplemented in broiler diets at 2.0% level for its beneficial potentials to animal and human health.

Key words: Garlic, antioxidant, nutrition, broilers, supplementation

Introduction

The interest of developing countries in promoting the production of fast-growing animals such as poultry came as a result of the increasing demand for animal protein (Obinne and Okorie, 2008). In Nigeria, the consumption of animal protein is below the recommended level of 56 grams per day (Adesehinwa, 2008). This poses a threat to food security and may lead to malnutrition. The restricted use or ban on antibiotics in poultry feeding has attracted the interest of poultry nutritionists to search for suitable herbal alternatives, which will improve health and productivity (El-Deek *et al*., 2003). Alternative growth promoters such as phytogenic plants are added to poultry diets to improve utilization of nutrients. Their positive effects can be expressed through improved feed intake, body weight gain, feed conversion ratio (FCR) and stimulation of body immunity. Herbs such as garlic are a commonly used spice which has been reported to have beneficial effects on the physiology and growth performance of chickens (El-Deek *et al*., 2003). In pursuit of improved chicken health and the need to fulfil consumer expectations in relation to food quality, poultry producers commonly utilize natural feeding supplements, mainly herbs (Gardzielewska *et al*., 2003). Garlic has been reported to possess anti-oxidative potentials which may help to lower or prevent incidences of cancer development in body tissues as reported by Pourali *et al.* (2014).

Since garlic consumption can be hampered by odour and its burning taste in the mouth, it may be helpful to include it in broiler diet after which the meat once consumed may provide the desired antioxidant benefits. Hence, the study was carried out to determine the effect of varying levels of dietarygarlic (*Allium sativum* L.*)* supplementation on serum antioxidant activity and economic benefit of broiler chickens

Materials and Methods

Experimental site

The experiment was carried out at the Teaching and Research farm, in the poultry unit, of the Department of Agricultural Technology, Federal College of Forestry, Jos-Plateau State. The farm is located on latitude 90 56'49.0" N and longitude 80 53'34.1" E, at an altitude of 1250m above sea level. The temperature of the area ranges between 21-25^{o}C depending on the season. The wet period in Jos is between April and November with annual rainfall between 1200 – 1500mm (FCF, 2019).

Source of broiler chickens

A total of one hundred and twenty (120) broiler finisher chickens of Arbor acre strain were used for the experiment. The birds were purchased at day old from Agrited hatchery located in Ibadan, Oyo state, South western Nigeria.

Source and processing of fresh garlic bulbs

Fresh garlic bulbs were purchased from new market in Jos, Plateau State, after which they were processed for incorporation in the diets. They were processed by removal of the outer coating, chopping, drying and milling before incorporation in the diets.

Experimental diets

Four iso-caloric and iso-nitrogenous diets having 3003.00 Kcal/Kg ME and 20.0% CP were formulated to meet the requirement of the chickens. The following ingredients were used for formulation of the diets; Maize- 61.40, Soya cake- 24.00, GNC- 5.90, Blood meal- 0.2, Bone meal- 2.90, Limestone-1.20, Garlic-1.00, common salt- 0.30, Vitamin Premix- 1.25, Lysine- 0.20, Methionine- 0.20 and Palm oil- 1.65. Chickens in the control group did not have garlic supplementation in their diets while it was supplemented in diets for chickens in treatments two, three and four at 1.0, 1.5 and 2.0% respectively.

Experimental design

A total of 120 broiler finisher chickens were used for the experiment which lasted for 28 days. They were assigned to four treatment groups each having ten chickens per replicate in a completely randomized design. All management practices were adhered to during the feeding trial.

Determination of serum antioxidant activity in broiler chickens fed garlic-based diets

At the end of the 28-day feeding trial two chickens were randomly selected from each replicate for determination of serum antioxidant activity. About 3 mls of blood sample was collected via the wing web of each chicken and transferred to sample bottles not containing anti-coagulant (EDTA). Blood collection took place early morning at 7:00am. The samples were taken to the Biochemistry Laboratory, National Veterinary Research Institute Vom, Plateau State to determine antioxidant enzymes activity (Superoxide dismutase, Catalase and Glutathione peroxidase) according to procedures of Winterbourne *et al.* (1975), Placer *et al.* (1966) and Hafeman *et al.* (1974) respectively. Malondialdehyde (MDA), an indicator of lipid peroxidation was also determined according to procedures of Hafeman *et al.* (1974).

Data analysis

Data obtained from the experiment were subjected to analysis of variance using the general linear model procedure of SAS (2001). Significant differences among treatment means will be separated using Duncan (1955) option in the same software.

Results

Serum antioxidant activity of broilers chickens fed diets containing varying levels of garlic

The serum antioxidant activity of broiler chickens fed diets containing varying levels of garlic is presented in Table 1. It showed that malondialdehyde (indicator of lipid peroxidation) was significantly ($P<0.05$) lower in chickens fed 2.0 % garlic-based diet compared to others. This oxidative deterioration increased across the treatments as the levels of garlic supplementation decreased. This is consistent with Pourali *et al* (2014) who reported that malondialdehyde levels decreased among chickens fed diet containing 0.5% garlic powder. Other reports from researchers (Horie *et al*., 1989; Knasmuller *et al*., 1989; Kourounakis and Rekka, 1991; Chung, 2006) showed the efficacy of garlic preparations or extracts in alleviating occurrence of free radical damage in biological membranes.

Table 1: Serum anti-oxidant activity of broiler chickens fed diets containing varying levels of garlic

	Levels of Garlic supplementation (%)				
Parameters	0.0	1.0	1.5	2.0	SEM
Catalase	10.83^{d}	11.92^{c}	12.72^{b}	14.04^{a}	0.01
Glutathione Peroxidase	1.25^{c}	1.15^{d}	1.32^{b}	1.62^{a}	0.01
Superoxide Dismutase	41.24^{d}	47.64^{b}	45.02^{c}	53.92^{a}	0.01
Lipid Peroxidation	2.83^{d}	2.64^{c}	2.27^{b}	1.75^{a}	0.01

a, b, c, d=Means with different superscript on the same row differ significantly, SEM= Standard error of mean

Economic benefit of feeding broiler chickens with diets containing varying levels of garlic supplementation

The economic benefit of supplementation of varying levels of garlic in broilers diets is presented in Table 2. Feed cost and total feed cost were highest in chickens fed diet containing 1.5% garlic supplementation. Feed cost also decreased across the treatment groups as the levels of garlic supplementation decreased. Total weight gain was highest in chickens fed 2.0% garlic-based diet followed by chickens fed 0.0% garlic-based diet. Total feed intake was higher in chickens fed garlic-based diets, giving an indication that garlic supplementation enhanced feed palatability. This may be implicated in the quantity of feed consumption at (₦280.83) at 2.0% garlic-based diet. Thus, total weight gain increased by about (0.41 kg) at 2.0% level of garlic supplementation. Although feed cost per gain increased by (₦223.81) among chickens fed garlic-based diets, it is a reflection of the feed consumption which was higher than the control group. Contrary to the result of cost benefit obtained in this study, total feed cost and cost of gain decreased with supplementation of phytogenic leaf extracts in broiler diets according to result of Maidala *et al.* (2017).

Table 2: Economic benefit of feeding broiler chickens diets containing varying levels of garlic

	Levels of garlic supplementation (%)			
Parameters	0.0	1.0	1.5	2.0
Total Feed Intake (kg)	4.60	4.85	4.70	4.95
Feed Cost (₦)	443.57	460.55	477.69	468.94
Total Feed Cost (₦)	2040.42	2233.67	2245.14	2321.25
Total Weight gain (kg)	2.23	1.97	2.05	2.38
Feed cost/Gain (₦/kg)	913.75	1137.56	1098.69	1003.53

Kg= Kilogram, ₦= Naira, ₦/kg= Naira per kilogram

Conclusion

The study observed that garlic supplementation in broiler diets was potent at lowering lipid peroxidation due to the activity of serum antioxidant enzymes. This can improve poultry meat quality and in turn human health when the meat is consumed. Garlic supplementation increased feed intake but did not lower feed cost per gain. The study conclude that garlic can be supplemented in broiler diets at 2.0% level of supplementation for its beneficial qualities to animal and human health.

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