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Evaluating Pepper (Capsicum annuum) and Garlic(*Allium sativum)* on Performance Egg Trait and Serum Parameters of Old Layers

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Abstract
This study was conducted to investigate the effects of garlic powder and dried pepper on performance, egg traits and serum parameters of laying chickens.
A 10 week study was carried out using 90 ISA brown layers that have laid eggs for 2 years. The diets were formulated such that diet I with 0% pepper and garlic served as the control, while diets II and III had 4g/kg of powdered garlic and dried pepper respectively. The layers were divided into 3 groups fed on these diets and replicated thrice. Data were analyzed by ANOVA using a completely randomized design.
Results showed that feed consumption, efficiency and egg weight were similar across the diets (P=0.05). There were improvements (P<0.05) in hen day production, egg albumen index and haugh unit of garlic fed layers. Egg yolk cholesterol of layers fed the garlic-supplemented diet reduced (P<0.05) compared with control diets. Serum total protein of garlic-fed layers increased ($P < 0.05$), while blood glucose and cholesterol levels decreased.
In conclusion garlic improved performance characteristics and may increase egg shelf life as indicated by egg quality improvement.
Keywords: Garlic powder, dried pepper eggs and layers

1. Introduction

The production and supply of meat and eggs to meet the people's dietary demand for animal protein is of great concern. The sub-optimal consumption of animal protein by a large percentage of Nigerian population has posed a challenge to livestock farmers, researchers and the government. To reduce the gap between demand and supply of animal protein, poultry can play an important role. As a result, poultry industry has been expanding vastly in the last few decades to meet this challenge(Olubamiwa et al 2002). Poultry meat itself is highly digestible, palatable and its egg an excellent food that contains 12-13% crude protein of an egg weight. The eggs are also used in various food industries in the manufacture of confectionery cosmetics production of vaccine as reported by (Oluyemi and Robberts 2007). From these perspectives the improvement of poultry layer birds cannot be over emphasized. Aging is a process which affects all the systems and activities of human as well as animal. With increasing age physical health mental alertness and performance of animals gradually reduce (Blagosklonny2009). As these birds advance in age laying capability dwindles. Reactive oxygen species and nitrogen species are formed in the body and endogenous antioxidant defences are not always sufficient to counteract them completely.
A great number of spices and aromatic herbs contain chemical compounds exhibiting antioxidant properties (Abdulahad and Ismail 2012). Ginger, garlic pepper and curry leaf are common medicinal herb used in human diet. These herbs are known spices which improves digestibility inspite of age. The attractive red color of peppers is due to their various carotenoid pigment which are synthesized during ripening. These carotenoids include capsanthin,capsorubin and crypto-capsin (Deepa et al 2007).It has long been considered that garlic (Allium sativum) has several beneficial effects for both humans and animals having antimicrobial, antioxidant, as well as antihypertensive properties(Konjufca et al1997: Sivam2001). Much of age related diseases resulting from damaged tissues caused by the accumulation of free radicals and toxins in the body can be reduced with pepper intake.
The same property can be used in poultry to increase the feed conversion ratio which results in increased body weight and more profit. Based on this objective this research was conducted to investigate if the inclusion of garlic powder and dried red pepper to the diets of old egg laying chicken can assist in improving egg laying capability and their general performance.

2. Materials and methods

2.1Experimental diets
Fresh garlic bulbs (*Allium sativum*, var. Chinese white garlic)and dried pepper were purchased from Bodija market Ibadan Nigeria. The dry skins of the bulb were removed before use; then the cloves were peeled and crushed finely by using a kitchen hand held grater sundried. Dried pepper was ground in a blender machine into

a fine powder form. Three experimental diets were compounded such that diet I with 0% garlic and pepper served as the control while diet II had 4g/kg of dried pepper and III had garlic.

2.2 Birds and management

The experiment was conducted at the Teaching and Research Farms of Bowen University Iwo with the environmental temperature range of 15- 28^{o}C during the dry season with mean annual rainfall of 1400mm. Ninety layers which were 126 weeks old were assigned to these dietary treatments and replicated thrice. Feed and water were provided ad libitum the feeding trial lasted for ten weeks. Standard routine management were carried out which include draining of remaining water, washing of the watering trough supply of fresh water. Removal of poultry dropping from feeds in the feeders and addition of fresh feed on daily basis. Eggs were picked twice a day.

2.3 Blood Analysis

At fifth and last week of the study three birds per replicate were randomly selected and bled by puncturing the jugular vein blood was collected in carefully labeled specimen bottles for estimation of serum metabolites. The blood was allowed to clot and the serum decanted after centrifugation. Serum total proteins (albumin and globulins) were determined according to the method of (Doumas1975). The glucose fraction was determined using the method of (Bonder and Mead 1974), total cholesterol according to (Allain et al1974), triglycerides were estimated according to the method described by (Stein 1986). Urea was estimated by the diacetylmonoxine method described by Fawett and Scott (1960) and modified by Kaplan and Szabo (1979).Aspartate amino transferase (SAST) and Alanine amino transferase (SALT) were analysed using a method described by Auckers(1970).

2.4 Egg Quality Analyses

Egg quality comprises a number of aspects related to the shell, albumen and yolk and may be divided into external and internal.

Eggs were collected twice daily and pooled together on replicate basis and carefully labelled. Weekly egg production was determined by collecting eggs laid per replicate every day and pooling together so as to count the total eggs collected for seven days. Percent hen day production was calculated as the percent of the ratio of the total number of eggs and the total number of days by number of hen i.e [total number of eggs/ (total number of days x number of hens)] x100. Parameters measured included the haugh unit, albumen weight, hen day production; ten eggs per replicate were randomly selected from the pool of eggs laid for the egg quality analysis once in a week for the period of trial. The weights were taken and the eggs were broken with the aid of a blunt edged knife so as not to rupture the albumen. The contents of each egg so broken were carefully transferred to a clean level glass plate. The shells were washed under slightly flowing water to remove albumen remains. Some other internal and external quality traits of the eggs like yolk weight albumen ratio haugh unit were obtained using the formulae as stated by (Kul and Seker 2004).

Albumen index was calculated as (albumen height/average of albumen length (mm) and albumen width (mm) x100. The cholesterol content of egg yolk was determined adopting colorimetric method based on Liebermann-Burchard colour reaction as described by (Huang et al 1961).Total lipids were extracted from egg yolk, the harvested extracts were allowed to react with acetic anhydride and concentrated sulphuric acid resulting in the formation of a blue-green complex. Egg yolk content was quantified by comparing the colour absorbance at 550 nm resulting from the Liebermann-Buchard reactions in egg yolk lipid extracts with cholesterol standards (Cholesterol reagent, Gainland Chemical Company, Uk).All the readings were blanked against a chloroform:methanol.

2.5 Chemical analysis

Samples of diets were analyzed for proximate composition and detergent fiber components using the procedures of (AOAC2000) and (Goering and Van Soest1970) respectively.

2.6 Statistical analysis

All data were subjected to analysed using StatView (version 5,SAS Institute Inc.,Cary,NC). A one- way ANOVA was performed using the GLM model to test the treatment effect on feed intake, egg production, egg weight and body weight of variance while treatment means were separated by Least significance difference method.

3. Result

The gross composition of the experimental diet is as shown in Tables 1.The diets were observed to be numerically close in dry matter and crude protein which met the nutrient requirement of the layers. The performance and egg qualities of the layers are as shown in Table 2 .The feed consumption and feed efficiency were similar across the diets (P=0.05).Yolk cholesterol of eggs laid by garlic fed layers reduced in reference to control (P<0.05).Table 3 shows the blood serum parameters The normal levels of AST and ALT observed for garlic and pepper fed layers in this investigation was indicative of healthy layers despite advance in age. The

total protein of garlic fed layers increased (P<0.05) while the blood glucose and cholesterol levels decreased when compared to control and pepper diet. Similarities were found in the values obtained among layers on diets I-III for the body and egg weight. The hen day production of garlic fed layers improved significantly (P<0.05) having 61.33% compared to 58.14 and 55.59% of pepper and control respectively. **Discussion**

During the ten weeks of feeding trials, there were no effect of the dietary treatment on feed consumption feed efficiency. The feed intake of layers on garlic diet was higher numerically than control and pepper containing diet. It could be ascertained that garlic brought about morphological changes in the birds which translated into improvement in the digestive system of layers. It probably enhanced the activities of the enzymes and provided micro environment for better nutrient utilization in the layers. Hen day production fig I revealed improvement with layers on garlic diet having 61.33% this result deviates from the findings of (Reddy et al 1991) and (Chowdhury et al 2002) who reported that supplementation of garlic did not affect egg production. However the findings here was similar to report of (Khan et al 2008) who concluded that feeding 8% dried garlic powder may result in better egg production in Desi laying hens,with no effect on egg mass and egg weight. The differences in the results of these various researchers may be due to the different experimental protocols and garlic preparation (Canogullari et al 2010). Haugh unit and albumen index of layers were affected with those on garlic diet having the best values. This was consistent with the findings of (Safaa 2007) who reported that 2.0% addition of dietary garlic increased yolk weight yolk colour and haugh unit which could be due to less lipid and protein oxidation. Similarities were found in the values obtained among birds on all the treatments for the egg weight. Contrary to the findings of (Yalcin et al2006) who reported increased egg weight when laying hens were fed 5 and 10g/kg garlic powder. The improvement in haugh unit connotes improved egg quality by garlic. This result agrees with the findings of some previous researchers (Pappas et al 2005), who proposed that organic selenium enhances the egg's antioxidant status by upgrading the glutathime peroxidase activity in yolk and albumen. The reduced egg cholesterol recorded in this study was possibly due to the garlic being able to inhibit the enzyme activity controlling formation of mevalonic acid.

Blood total protein of garlic fed layers increased which is reflecting the condition of these experimental birds and the changes happening under the influence of dietary treatment. This could be attributed to the increase in the immunoglobin level and total globulin concentration. It also implied that the birds were not dehydrated. This corroborates the findings of (Hussein 1996) who reported high serum protein levels due to improved liver and other organs functions which synthesized plasma protein. Since albumin and globulin add up to give total protein they also had the statistical trend with total protein. Blood cholesterol decreased on garlic diet, this could be explained with the fact that sulphur containing compound of garlic allicin might have increased the oxidation of plasma and cell lipids by improving the layers health. According to (Canogullari et al 2010) it is believed to reduce cholesterol synthesis, inhibit fatty acids synthesis and platelet aggregation thus prevents thrombosis. This could also be explained with the findings of (Quresh et al 1983) who reported decreases in hepatic 3-hydroxy -3methylglutaryl-COA reductase, cholesterol7α-hydroxylase fatty acid synthetase which usually accompanied the feeding of petroleum ether-methanol and water soluble fraction of garlic. This was in agreement with (Chowdhury et al 2002) who reported reduction of serum and egg yolk cholesterol and said it was due to reduction of synthetic enzyme activity in garlic fed layers. The cholesterol lowering effect of garlic may be due to an increase of bile acid excretion as suggested by (Erdman 2000)which occur through an interference with the absorption of cholesterol this was in agreement with (Shin et al2004) Glucose concentrations of layers fed were reduced when compared to control. This was attributed to the antioxidant properties of these test ingredients as ability of the older birds to cope with lipid peroxidation is improved upon. Serum urea is a function of protein quality high urea is an indication of poor quality. In this study serum urea was within normal range among the treatment. Although numerically those fed garlic had higher values than pepper and control. The normal levels of AST and ALT observed for garlic and pepper fed layers in this investigation was indicative of healthy layers despite advance in age. This also confirmed absence of liver diseases in the experimental birds. This was due probably to the test ingredients antioxidant properties thereby preventing unhealthy reactions of free radicals with lipids proteins and other molecules causing them to lose their structure and function. These properties are attributed to various active phytochemicals including vitamins, carotenoids, terpenoids, alkaloids, flavonoids lignans, simple phenols acids and so on (Liu and Ng 2000) this result was similar to the findings of (Moure et al2001).Red pepper was found to have high levels of antioxidant like phenolics and flavonoid content these have modulating role on physiological functions and biotransformation reactions involved in detoxification process thereby providing protection from cytotoxic,genotoxic and metabolic effects of environmental toxicants (Saha and Das 2003). It could also be due to their stimulant, carminative digestion and antimicrobial properties as suggested by (El –Husseiny et al 2002). So inclusion of garlic or pepper caused stabilized cell membrane and protects the liver against deleterious agents and free radical mediated toxic damages to the liver cells which is desirable. The antioxidant properties of garlic and/or pepper is implicated since it has been reported that all antioxidants can help strengthen immune system, allowing body to produce strong, healthy white blood cells to

counterattack bacteria and other foreign organisms.

5. Conclusion

In the main this study shows that garlic as an additive in the diet of old layers promoted improvement in egg laying ability and egg quality traits better than pepper.

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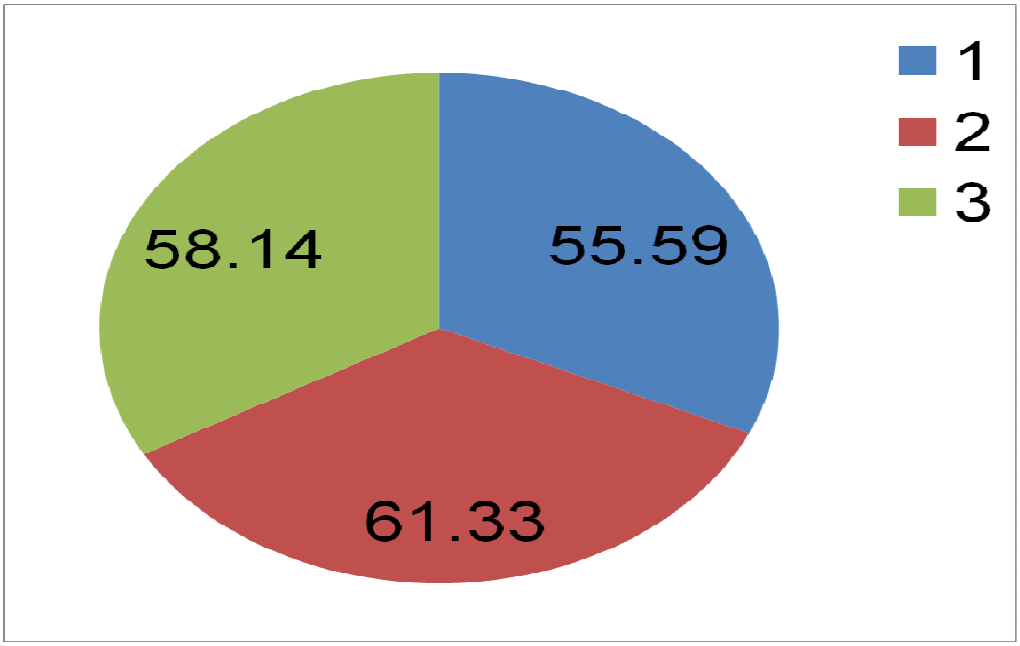

Fig I Hen day production of layers

Table 1 Gross composition of experimental diets.

Ingredients	I	II	III
Maize	41	41	41
Wheat bran	14	14	14
Palmkernel cake	14	14	14
Soybean meal	6.0	6.0	6.0
Groundnut cake	11.5	11.5	11.5
Garlic	0	0.04	0
Pepper	0	0	0.04
Fish meal	3.0	3.0	3.0
Oyster meal	3.0	3.0	3.0
Bone meal	7.0	7.0	7.0
Salt	.25	.25	.25
Layers premix*	.25	.25	.25
Methionine	0.1	0.1	0.1
Lysine	0.1	0.1	0.1
Calculated analysis(%)			
CP(%)	17.35	17.35	17.35
ME kcal/kg	2500	2500	2500

*To provide the following per kg diet, vitamin A 10,000in, vitamin D3 1500iu, Vitamin E3iu, Vitamin K 2mg,riboflavin 3mg, Panthothenic acid 6mg, niacin 15mg, chlorine 5mg, vitamin B12 0.08mg, folic acid 4mg, Mn8mg, Zn 0.5mg, iodine 1.0mg, Co 1.2mg and Fe 20mg.

Table 2 Layers performance and egg quality characteristics

Parameters	I	II	III	SEM
Feed intake g/day	110.06	114.36	112.00	0.03
Body weight gain(g/day)	214	212	210	2.13
Hen day production(%)	55.59 [a]	61.33 [b]	58.14 [ab]	4.70
Egg weight(g)	59.87	62.81	60.56	7.99
Albumen index%	21.67 [a]	25.85 [b]	22.50 [a]	1.03
Haugh unit%	70.11 [a]	77.35 [b]	71.25 [b]	6.65
Egg yolk cholesterol(mg/g)	10.84 [a]	4.21 [c]	7.66 [b]	1.34

abc Means with the same superscript along a row are not significantly different (P>0.05

Table 3 Blood profile of layers fed the experimental diets.

Diets	**I**	**II**	**III**	**SEM**
Parameters				
Total protein(g/dl)	6.63 [b]	7.89[a]	6.56[b]	0.05
Albumin(g/dl)	3.33 [b]	3.49 [a]	3.08	0.04
Globulin(g/dl)	3.30 [b]	4.40[a]	3.46[b]	0.03
Creatinine(mg/dl)	1.43[c]	1.53[b]	1.60[a]	0.02
Glucose(mg/dl)	191.18[a]	182.18[b]	185.33[b]	1.28
Urea(mg/dl)	6.33	6.08	6.16	0.04
Cholesterol(mg/dl)	113.21[a]	100.71[b]	103.92[b]	1.25
SAST(IU/L)	43.83[a]	40.54[b]	39.98[c]	0.26
SALT (IU/L)	21.33[e]	22.65[b]	22.82[b]	0.44

abc Means with the same superscript along a row are not significantly different (P>0.05)