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Email: tajar2011@yahoo.com, tajar2011@gmail.com
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REPRODUCTIVE RESPONSE AND PREDICTIVE PRODUCTIVITY OF DOMESTIC FOWL (BREEDER STOCK) TO GARLIC SUPPLEMENTED DIETS

A.O, Adeyina, A.S Akanbi, R. Adepoju and B.H Raji
Department of Animal production, University of Ilorin, Nigeria.
Corresponding author: aadeyina@yahoo.com

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Abstract
Reproductive response and fertility of breeder's stock to garlic-supplemented diet were investigated in an eight (8) week experimental trials. A total of 52 birds (12 cock and 40 hens) of Rhode Island Red of forty weeks old were used for the trials. The birds (3cocks and 10 hens) per treatment were assigned into four treatment group of feed supplemented with garlic at 0.0, 1.0, 2.0 and 3.0g/kg feed in a completely randomized design layout. Semen collected from the cocks were analysed and the hens were artificially inseminated within treatment. A total of 80 eggs were collected over a 3day period and set in an incubator for fertility and hatchability testing. The haematological parameters (PCV,Hb,WBC and RBC) were not significantly ($p>0.05$) affected with garlic supplementation. The increase in follicle stimulating hormone (FSH) and testosterone from the cock were not significant ($p>0.05$). Sperm concentration and motility significantly ($p<0.05$) decreased with increased level of garlic supplementation. Percentage fertility and hatchability of eggs decreased significantly ($p<0.05$) with increase in garlic supplementation. It was concluded that garlic supplementation in diet of breeders stock has the ability to reduce fertility in cock, viability and hatchability of eggs from hens and could be used in a controlled breeding programme.

Key words: Reproduction, Garlic, Birds, Hatchability, Diet.

Introduction

The reproductive potential of poultry breeder birds is determined to a large extent by the quality of gametes produced. In the hatchery industry, a large number of eggs set for incubation may not hatch due to infertility resulting from production of low viable gamete. The efficiency and quality of gametes may be altered by increasing age which often results in decreased fertility (Banerjee *et al.*,2001) The assessment of semen equality has been reported to be a major determinant of fertility and subsequent hatchability of egg (Parker and McDaniel, 2002).

Replacement of breeders stock in the hatchery industry is quite expensive therefore, it is expected that commercial hatcheries extend the productive life of their stock as long as it is profitably desirable. One alternative to maintain fertility is the use of aphrodisiac plants that stimulate Nitric Oxide Synthase (NOS) enzyme which causes erection in animal (Block, 2010). Although garlic has been reported to contain NOS and as such among aphrodisiac plant that can restore sexual power (Oi *et al*,2001) in addition to its renown health benefit in cardioprotective (Ried *et al.*, 2001) and reduction of blood pressure in hypertensive patient (Milner, 2001), the major concern has been raised on its negative influence on male reproductive functions and sperm quality (Nasibeh and Arash, 2014).

However, the mechanisms of this action of garlic are not very clear as there are conflicting reasons for the action. Banerjee *et al*., (2001) suggested apoptosis to be the likelihood. The aim of this study therefore is to investigate the reproductive response and predictive productivity of domestic fowl (breeder's stock) to garlic supplemented diet.

Materials and Method

The study was carried out at the Teaching and Research Farm, Faculty of Agriculture, University of Ilorin, Kwara State, Nigeria with an average mean temperature of 32.5 degree Celsius and annual rainfall of about 900mm.

A total of 52 (12 cocks and 40 hens) Rhode island red birds of forty weeks old were used for this study. The birds were bought as spent from a Yamffy hatchery in Ilorin, Kwara State, Nigeria. The birds were housed under natural daylight with free access to respective diet and water ad-libitum in a battery cage system for a period of 8 weeks. Gallic bulbs was obtained from a reputable herbal store, air

cleaned, milled and mixed with the feed accordingly. Approval of University Ethical Committee was obtained before the commencement of the experiment.

The birds were divided into four treatment groups of three (3) cocks and ten (10) hens per group in a completely randomized design experiment and were housed in appropriate battery cages. Group 1(control) was fed garlic free breeders' ration (commercial feed) of 16% C.P and 2700kcal/kg metabolizable energy while groups 2, 3 and 4 had the controlled diet supplemented with garlic at 1.0 ,2.0, and 3.0g/kg of feed during an eight week experimental period. Other routine management activities were as described by (Kabir *et al*., 2004).

Semen was collected four weeks after the commencement of the experiment. The semen was collected twice a week by massaging the lateral lumbosacral region and abdomen gently that cause the erection of the male copulatory organ (papilla). The semen was squeezed out into a test tube pulled together for cocks within the same treatment and immediately analysed for semen volume, sperm concentration, sperm mortality and abnormality using the method described by Logue and Grey (1987) and Patrick *et al* (2009). Part of the semen collected was immediately withdraw using 1ml syringe and inserted into the left opening (cervices) of the reproductive tract of the hens within treatment. Two (2) drops (0.2ml) of the semen were released into the uterus of laying hens in each insemination.

A total of eighty (80) eggs were selected from eggs collected within 3 days from the female birds(twenty eggs per treatment group) and were incubated according to the procedure described by Banerjee and Keener (2012). Blood samples were also collected from the wing vein into the test tube in the eight week and allowed to stand for some time before centrifuging at 2500 rpm to obtain clear sera. Follicle stimulating hormones and testosterone were determined from the serum using Elisa procedure of Thakur (2009). Packed Cell Volume (PCV), haemoglobin, white blood cell count, red blood cell count, Neutrophy and lymphocyte were determined according to the procedure of Schalm *et al*., (1975).

The fertility of eggs were determined at the 5th and 18thday of incubation using a candling machine. The percentage fertility and hatchability were determined as follows.

$$\% \text{ fertility} = \frac{\text{Number of fertile egg}}{\text{Number of egg set}} \times \frac{100}{1}$$

$$\% \text{ hatchability of egg set} = \frac{\text{Number of chicks hatched}}{\text{Number of egg set}} \times \frac{100}{1}$$

All data collected were subjected to analysis of variance (ANOVA) in a complete randomized design. Significant differences were compared using Duncan Multiple Range Test (Duncan 1955).

Results and Discussion

The haematological indices of cocks fed garlic at different inclusion levels are presented in Table 1.

Table 1: Effect of garlic (g/kg) on haematological and hormonal indices of cock

Parameter	Garlic (g/kg)				SEM
	0.0	1.0	2.0	3.0	
PCV (%)	37.00	41.00	40.00	37.00	4.96
Hb (g/dl)	3.75	4.65	4.50	4.30	0.74
WBC($x10^3/mm^3$)	8.65	8.85	8.50	9.00	0.93
RBC($x10^6/mm^3$)	3.30	3.60	2.15	2.80	0.37
Neut(%)	67.00	71.50	66.00	68.00	1.68
Lym(%)	33.00	27.50	34.00	32.00	1.51
FSH(miu/ml)	0.58	1.44	2.67	3.16	0.04
Testosterone(miu/ml)	8.28	8.88	8.82	11.16	0.20

PCV- Packed cell volume, Hb-Heamoglobin, WBC- White blood cell count, RBC- Red blood cell count, Neut- Neutrophils, LYM- Lymphocyte FSH- follicle stimulating hormone.

The parameters measured were not significantly ($p>0.05$) different and are within the normal range for chickens, suggesting that garlic supplementation in the diets is not detrimental to the health status of birds because, administration of garlic augments the activities of hepatic superoxide dismutase (SOD) and also protect the cells against the damaging effects of free radicals (Isaacsohn *et al*,1998).

Table 2 shows the effect of garlic on semen characteristic and hormonal profile. The semen characteristic in terms of semen volume, sperm concentration, sperm motility, progressive assessment and total count per ejaculate significantly decreased ($p<0.05$) with increase in garlic supplementation.

Table 2: Effect of garlic on semen characteristics of cocks (MEAN±SEM)

Parameter	Garlic (g/kg)			
	0.0	**1.0**	**2.0**	**3.0**
Concentration(x10^6/ml)	400^{c}±42.43	210^{b}±14.14	150^{ab}±28.28	120^{a}±28.28
Motility count (x10^6/ml)	390^{b} ±70.71	200^{a}±28.28	120^{a} ±28.28	88^{a} ±2.82
Motility (%)	98^{c} ±0.71	95^{c}±1.41	80^{b} ±14.14	66^{a} ± 8.49
Total count/ ejaculate (x 10^6)	360^{c} ±14.14	147^{b} ± 18.39	45^{a} ± 70.07	72^{a} ±2.83
Volume	0.9 ± 0.141	0.7 ± 0.141	0.6 ± 0.141	0.6 ± 0.141
Progressive assessment (%)	90	85	80	75
Colour	Creamy White	Creamy white	Dirty white	Dirty white

Means with different superscript on the same row are significantly different (P< 0.05)

This decrease reveals that garlic has negative effects on semen quality and functionality. This is a suggestive signal that garlic has spermicidal effects and could arrest spermatogenesis (Dixit and Joshi 1982). Spermatogenesis and other reproductive functionality could be compromised because garlic is associated with increased percentage of empty seminiferous tubules (Banerjee *et al.,*2001). Garlic contains antioxidant known as allicin which could negatively influence sperm quality and viability (Block, 2010). The values of follicle stimulating hormone and testosterone significantly increased (p<0.05) with increase in garlic supplementation. This could be the reflection of the stimulatory ability of garlic as a result of allicin and its derive (Block, 2010). This result corroborates the report of Oi *et al*., (2001) that showed an increase in testosterone level after administration of 8% of garlic powder.

Table 3 shows the effect of garlic on semen morphology. The percentage of normal sperm significantly (p<0.05) decreased with increase in garlic supplementation while the percentage sperm deformities significantly (p<0.05) increased with increase in garlic supplementation.

Table 3: Effect of garlic on semen morphology of cocks

Parameter	Garlic (g/kg)				SEM
	0.0	**1.0**	**2.0**	**3.0**	
Normal (%)	80.00	75.00	70.00	65.00	1.72
Head defect (%)	10.00	10.00	25.00	25.00	1.65
Total Defect (%)	85.00	10.00	10.00	10.00	1.40
Neck defect	5.00	5.00	55.00	5.00	1.08

This reveals the spermicidal characteristic of garlic and its resultant effect in causing irreversible immobilization thereby causing reduction in sperm viability. This result may probably be the reason why garlic is used as a natural contraceptive (Ogbuewu *et al.,* 2011) in male.

Table 4 shows the effect of garlic on fertility and hatchability of eggs set.

Table 4: Effect of the garlic on fertility and hatchability of egg sets

Parameter	Garlic (g/kg)				SEM
	0.0	**1.0**	**2.0**	**3.0**	
NFE (%)	20.00	19.00	15.00	13.00	0.87
NHE (%)	19.00	15.00	12.00	8.00	0.97
Fertility (%)	100.00	95.00	75.00	65.00	1.77
Hatchability (%)	95.00	79.00	80.00	62.00	4.22

NFE- Number of fertile egg, NHE- Number of hatched eggs

The results revealed that fertility and hatchability of eggs decreased with increase in garlic supplementation in both quantity and quality of semen on egg fertility and hatchability. The decrease in percentage fertility and hatchability of egg being the resultant effect of garlic on sperm viability.

Conclusion

In conclusion, the effect of garlic may not be unconnected to the suggested mechanism of apoptosis and reduction in sperm quality and viability. At these levels of supplementation in this study, garlic cannot be used to improve reproductive performance beyond 1g/kg of feed in old breeder's stock.

Higher inclusion of garlic will rather lead to low fertility and sperm count (contraceptive function of garlic).

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