APRW -02

Effects of Onions-Ginger Mix Supplementation on Motility of Local Breeder Cock Spermatozoa

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Abstract
A 35 - day trial was conducted to investigate the effect of dietary onion-ginger mix supplementation on motility of Nigerian local breeder cock spermatozoa. Thirty six local breeder cocks were divided into 2 treatment groups (T_1 and T_2) of 18 cocks each, and each group replicated thrice. Birds on T_1 treatment (control group) received basal diet supplemented with 0 g onions and 0 g ginger per 300 g dry matter (DM) feed for 3 weeks while those in group T_2 received basal diet supplemented with 5 g onions and 5 g ginger per 300 g per DM feed in completely randomized design. Semen was collected from the breeder cocks and two aliquots were taken from each ejaculate, one analyzed for sperm motility immediately after collection and the other three hours later. Semen samples for analysis were obtained from two cocks from each replicate and data obtained analyzed statistically. Results revealed that birds on diet T_2 had the highest sperm forward motility compared with birds on diet T_1 (88.75*vs*.77.50%; $p<0.05$). Birds on diet T_2 produced spermatozoa with increased ($p<0.05$) active motile cells and reduced ($p<0.05$) non motile cells compared with cocks on diet T_1. Birds on diet T_2 had spermatozoa with reduced sluggish cells, though the difference was not significant ($p>0.5$) compared with those on diet T_1. Results of semen analysis after 3 hours of collection showed that sperm forward motility and active motile cells were higher for birds on diet T_2 compared with birds on diet T_1, though the observed difference was not significant ($p>0.05$). Birds on diet T_2 produced spermatozoa with reduced sluggish motile and non-motile sperm compared with cocks on diet T_1. It can be concluded that supplementation of local breeder cock's diet with 5 g each of onions and ginger per 300 g DM feed improved sperm forward motility and active motile cells and reduced sperm with non-motile and sluggish cells.

Keywords: Phytoadditives, onions, ginger, breeder cocks, spermatozoa

Introduction

Artificial insemination is practiced regularly on medium and large sized poultry farms to improved productivity. Semen evaluation plays an importance role in the choice of breeder cocks to be used during poultry breeding. This is important because the contribution of the cock to the overall flock fertility become more critical as the ratios of male to female is low. The ability of the sperm to fertilize the egg is dependent on the structural and functional components of sperm membrane lipids. Poultry spermatozoa membrane is high in polyunsaturated fatty acids (PUFA) and this makes it more susceptible to lipid peroxidation by oxygen free radicals produced by mitochondrial and plasma membrane (Ogbuewu *et al.,* 2010). The antioxidant defense activity of sperm is low, but enzymatic and non-enzymatic antioxidants in the seminal plasma help to protect sperm from reactive oxygen species (ROS) (Zini *et al.,* 2009). However, over production of these free radicals decrease the antioxidant defense activity of the sperm thereby leading to low sperm motility, viability, DNA fragmentation and protein denaturation.

To counteract this negative effects of oxygen free radicals, several attempts have been made to improve the antioxidant capacity of seminal plasma by using tropical plants with antioxidant abilities such as garlic, onion and dried tomato pomace (Türk *et al.,* 2007; Saemi *et al.,* 2012; Akhlaghi *et al*., 2014; Okoro *et al*., 2016) with mixed results. The onion plant (*Allium cepa*) also known as the bulb onion is the most widely cultivated of the genus Allium. The flavonoids quercetin, an antioxidant found in onions, helps to protect the cells against oxygen free radicals attack. Okoro *et al*. (2016) reported an improvement in sperm quality parameters in Hubbard white breeder broiler cocks aged 35 - 41 weeks old fed onion and garlic based diets. Ginger (*Zingiber officinale*) belongs to the family Zingiberaceae. It is a herbaceous perennial herb that grows widely in the tropics. It is rich in essential oils and is used globally as a spice in human food. Pharmacological activities reported include androgenic and antioxidant (Ogbuewu, 2013). The most important bioactive compounds in ginger that might acts as a scavenger of oxygen free radicals are gingerols, shogaols and their derivatives (Zhang *et al.,* 2009; Zhao *et al.,* 2011).

The objective of this work therefore was to determine the protective effect of dietary onions-ginger mix on the spermatozoa motility using local breeder cocks as a model.

Materials and Methods

This study was carried out at the Teaching and Research Farm of the Department of Animal and Technology, Federal University of Technology, Owerri, Nigeria. Owerri lies between latitude $4^0\ 4^1$ and $6^0\ 3^1$N and longitude $6^0\ 15^1$ and $8^0\ 15^1$E. Thirty six Nigerian local breeder cocks (Normal feathered) were used in this study. They were randomly divided into 2 groups (T1 and T2) of 18 cocks each. A completely randomized design with 2 treatments and 3 replicates was used for this study. Birds in control group (T_1) were fed basal diet (Table 1) supplemented with 0 g onions and 0 g ginger per 300 g dry matter (DM) feed for 3 weeks

while those in group T_2 received the same basal diet but supplemented with 5 g onions and 5 g ginger per 300 g per DM) feed. The experimental cocks were trained for 14 days to ejaculate by abdominal massage method of Burrows and Quinns (1936). The birds were kept under natural conditions of light and ventilation.

Table 1. Ingredient and chemical composition of the basal diet fed to the local breeder cock (DM basis)

Ingredients	%
Maize	78.67
Soybean	16.40
Bone meal	1.60
Fish meal	1.20
Oyster shell	1.00
Common salt	0.28
Premix*	0.40
Methionine	0.40
Lysine	0.45
Composition	
ME (kcal/kg)	2793
CP (%)	14.62
Ca (%)	0.90
P (%)	0.50
L-lysine HCl (%)	0.52
DL-Met (%)	0.23

*Supplied per kg diet: vitamin A, 15 000 IU; vitamin E, 30 mg; vitamin K3, 4 mg; vitamin D3, 3000 IU; riboflavin, 7.5 mg; pyridoxine, 5.5 mg; vitamin B_{12}, 25 mg; biotin, 50 mg; niacin, 50 mg; calcium pantothenate, 18 mg, and folic acid, 1.5 mg; Fe ($FeSO_4.H_2O$), 90 mg; Mn ($MnSO_4.H_2O$), 90 mg; Zn (ZnO), 67.3 mg; Cu ($CuSO_4.5H_2O$), 10.9 mg, and Se (Na_2SeO_3), 0.18 mg.

The semen samples were collected at the 47th day of the experiment. The semen samples of every 6 cocks in each group were pooled and used for the determination of sperm motility. Sperm motility attributes (active motile (AC), non-motile (NM) and sluggish cells (SM)] were assessed subjectively (Bakst, 1980) under a light microscope DM300. Data were analyzed using the mixed procedure of SAS (2008). Differences between means were determined by t - test ($p<0.05$) and the results were presented as means ± SEM in bar charts.

Results and Discussion

Figures 1, 2, 3 and 4 shows the mean values for the sperm forward motility and sperm motility attributes in local breeder cocks fed diets supplemented with onions-ginger mix. Results revealed that after 1 h of semen collection, birds on diet T_2 had the highest sperm with progressive motility compared with birds on diet T_1 (88.75*vs*.77.50%; $p<0.05$). Birds on diet T2 produced semen with increased ($p<0.05$) active motile cells and reduced ($p<0.05$) non motile cells compared with cocks on diet T_1. Birds on diet T_2 had spermatozoa with reduced sluggish cells, though the difference was not significant ($p>0.5$) compared with those on diet T_1. Results of semen analysis after 3 hours of collection showed that sperm forward motility and active motile cells were higher ($p>0.05$), while the non-motile cells and sluggish cells were lower ($p>0.05$) for birds on diet T_2 compared relative those on diet T_1.

Tropical medicinal plants have been widely studied for a broad range of biological activities, especially antioxidant activities (Zhang *et al.,* 2009; Zhao *et al.,* 2011; Ogbuewu, 2013) and found that they reduce lipid peroxidation by enhancing the activities of the antioxidant enzymes such as super oxide dismutase, catalase and glutathione peroxides in animals. Cellular damage in the semen is the result of lack of balance between ROS generation and scavenging activities. Excessive ROS production that exceeds critical levels has been documented to overwhelm all the antioxidants defense strategies of spermatozoa and seminal plasma causing oxidative stress (Akhlaghi *et al.,* 20142). In the current study, feeding of 5 g onions and 5 g ginger per 300 g per DM) feed for 3 consecutive weeks improved sperm forward motility and active motile cells in experimental groups as compared with the control group. This increase in sperm motility of experimental groups in comparison to control group could be due to the protective effect of onion-ginger administration. This protective effect of onion – ginger in local breeder cocks is in harmony with the results of Hamza *et al.* (2006) who reported that ginger increased the activities of testicular antioxidants enzyme and restore sperm motility of cisplatin-treated rats. It can be concluded that supplementation of local breeder cock's diet with 5g each of onion and ginger per 300g DM feed improved sperm motility attributes.

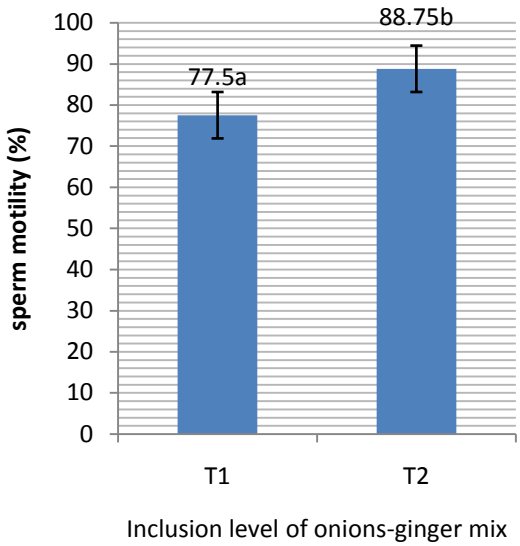

Fig. I: Effect of treatment on sperm forward motility of local breeder cock semen

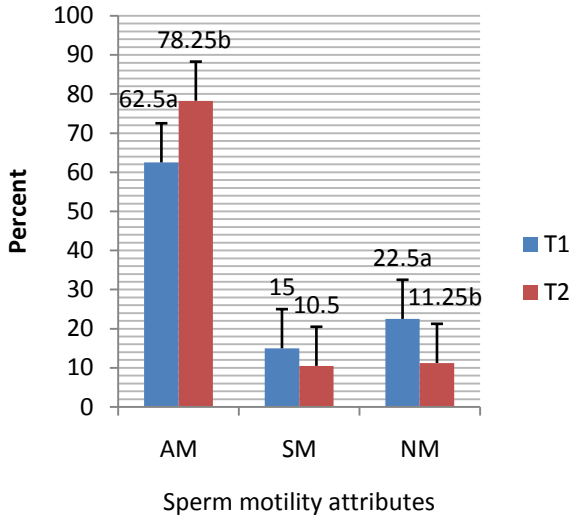

Fig. II: Effect of treatment on sperm forward motility attributes of local breeder cock semen

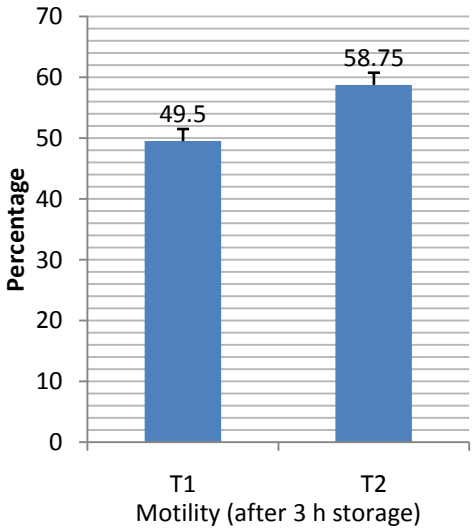

Fig. III: Sperm forward motility of local breeder cock semen after 3 hours of collection

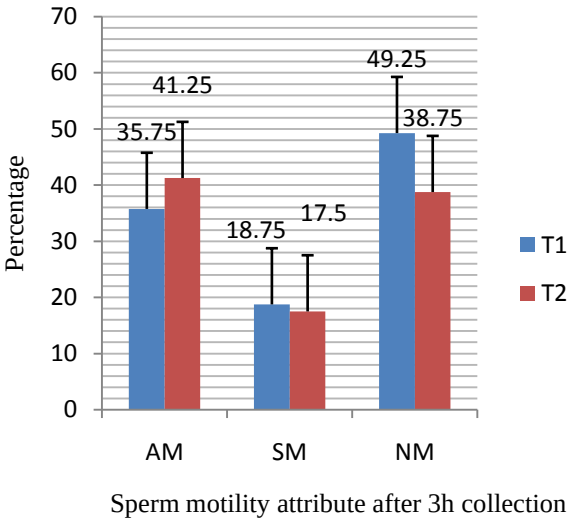

Fig. IV: Sperm motility attributes of local breeder cock semen after 3 hours of collection

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