

SEMEN CHARACTERISTICS AND HAEMATOLOGY OF NIGERIAN LIGHT ECOTYPE CHICKEN FED DIETARY INCLUSIONS OF ETHIOPIAN PEPPER (*Xylopia aethiopica*) FRUIT MEAL

I. E. UZOCHUKWU, B. C. AMAEFULE, H. N. FOLENG, M. EZEKWE AND C. N. OBETA

Department of Animal Science, University of Nigeria, Nsukka

Correspondence: ifeanyi.uzochukwu@unn.edu.ng; 08060484743

ABSTRACT

A 56 days study was done to evaluate the effect of Ethiopian pepper fruit meal (EPFM) on the semen quality and haematology of Nigerian indigenous local cocks. Thirty mature cocks were obtained and randomly assigned to five groups of six cocks each in a completely randomized design (CRD). Each treatment was replicated three times with two cocks per replicate. Birds in treatments 1,2,3,4 and 5 (T1, T2, T3, T4, and T5 respectively) were fed basal diets containing EPFM at 0,2,4,6 and 8g/kg diet respectively. Standard management practices were observed throughout the experimental period. Semen was collected after two weeks of treatment at intervals of four days for a period of six weeks. At the 8th week of the study, blood samples were also collected for haematology analysis. Data collected were subjected to analysis of variance. Results showed that the physical semen characteristics: semen volume, sperm concentration, sperm motility, percentage live and normal sperm cells and sperm count were significantly ($P<0.05$) affected by the treatment. The semen quality characteristics were observed to improve ($P<0.05$) up to 4g of EPFM (T3) compared to the control. At and above 6g/kg diet, EPFM was observed to significantly reduce ($P<0.05$) the semen quality. Total sperm per ejaculate for cocks in T₁, T₂, T₃, T₄ and T₅ were 1.28, 1.61, 1.44, 0.87 and 0.73 respectively. The result of the haematological parameters showed no significant ($P>0.05$) difference among the different treatment groups in the PCV, RBC, WBC, HB, neutrophils, and lymphocyte. It was concluded that EPFM could be used to improve semen quality of cocks up to 4g/kg diet without detrimental effects.

Keywords: *Xylopia aethiopica*, Semen, Evaluation, Haematology, Cocks.

INTRODUCTION

Xylopia aethiopica (XA/ African guinea pepper/ Ethiopian pepper) is an important medicinal plant in West Africa due to a variety of complex chemical compounds it contains. The various parts: fresh and dried fruits, leaf, stem bark and root bark essential oils show varying degrees of activity against several bacteria and certain fungi (Okigbo *et al.*, 2005). Its principal constituents, mono- and sesqui-terpene hydrocarbons are responsible for its antioxidant properties (Uyovwieseveva *et al.*, 2011). The stem, bark, fruits, seeds and roots of this plant are used for treating stomach-aches, dysentery, bronchitis, cancer, ulcer, fever and debility, rheumatism, post-partum management, fertility-enhancement and vermifuge (Ndukwu and Ben-Nwadibia, 2005). Also, this plant has been reported to increase menstrual blood flow, terminate unwanted pregnancy (Muanya, 2008), promote prostaglandin synthesis (Ezekwesili *et al.*, 2010),

and have hypotensive and diuretic effects (Somova *et al.*, 2001). Although extracts of XA have been reported to have anti-fertility and anti-androgenic properties in rats and human (Onyebuagu *et al.*, 2013), contrasting reports have suggested *X. aethiopica* to induce sexual motivation and performance in male rat and guinea pigs (Adienbo *et al.*, 2013) and to improve semen quality while possessing androgenic properties in rabbits and rats (Oguike and Archibong, 2011).

The Nigerian indigenous birds in addition to their local consumers' preference, have been reported to have many advantageous gene complexes or gene marker that could be harnessed in the development of meat and egg type chicken suitable for use in the tropics (Machebe and Ezekwe, 2004). The reproductive potential of poultry birds (cocks) is largely dependent on the quality of their semen and is a major determinant of fertility and subsequent hatchability of eggs

(Ajayi *et al.*, 2011). Despite the existence of contrasting reports on fertility roles of this plant, there is limited information on the effect of this plant on the reproductive performance of the poultry species. The present study was thus designed to evaluate the effect of dietary inclusion of *X. aethiopica* on the semen quality and haematology of Nigerian local cocks reared in the humid tropics.

MATERIALS AND METHOD

The study was conducted at the Poultry Unit of Animal Science Teaching and Research Farm, University of Nigeria, Nsukka in Enugu State, South Eastern Nigeria. The study lasted for a period of 10 weeks.

Preparation of Ethiopian pepper (*Xylopi aethiopica*) fruit meal

The whole dried fruits of *Xylopi aethiopica* were purchased from a local commodity market in Nsukka, Enugu State, Nigeria. The fruits were washed in clean water and air-dried for about 10 hours, after which the fruit pods were further dried in the oven at 40°C for 12 hours. Afterwards the dried fruits were ground into powder form. The grinding was done using mechanical grinding machine. The desired amount of the powdered *Xylopi aethiopica* fruit meal (EPFM) was measured using a sensitive digital weighing balance (Zohaus, Model CS 200, N.J. USA).

Experimental animals

A total of thirty (30) mature Nigerian light ecotype local cocks (normal feathered) with similar sizes and weights (between 1.3- 1.5kg) were purchased from the local commodity markets in Nsukka, Enugu State and used for the study. The birds were randomly assorted into five treatments groups: T1, T2, T3, T4, and T5 with six cocks per treatment. Each treatment was replicated three times with two birds per replicate. The birds were reared and managed intensively in deep litter housing system with all proper management procedures put in place. A basal diet containing 16.5% CP and 2530kcal energy was formulated and compounded for the study. The birds in treatments 1, 2, 3, 4, and 5 were fed the basal diet with inclusions of EPFM at 0, 2, 4, 6, and 8g/kg diet respectively. Feed and water were given to the birds fresh and *ad-libitum*.

Semen collection and evaluation

The cocks were trained for semen collection starting from the 2nd week of the study after which semen collection and evaluation was carried out for a period of 8 weeks. Semen was collected by abdominal massage techniques as described by (Hafez, 1978). Semen collection was done twice a week. Individual ejaculates were collected into 4 ml graduated collection tube from where the volume was read off. Following semen collection, the semen was maintained in a 35°C water bath for sperm motility assessment. The semen was analyzed as described by Peter *et al.* (2008).

Haematological analyses

At the 8th week, blood samples were collected from the wing vein using a 5ml and placed in sterilized bottles containing Ethylene Diamine Tetra-acetic Acid (EDTA) anticoagulant for determining the hematological values. The haematological parameters were determined using Mindray Haematology Analyser (Mindray BC-2300, Guangzhou Shihai Medical Equipment Co., Ltd, China).

Statistical Analysis

Data generated from the experimental trial were subjected to analysis of variance (ANOVA) using statistical package for social sciences version 20.0 (SPSS, 2016) and significantly different means were separated using Duncan's New Multiple Range Test (Duncan, 1955).

RESULTS AND DISCUSSION

The effect of dietary inclusion of Ethiopian pepper fruit meal (EPFM) on the physical semen characteristics of Nigerian light ecotype chicken is presented in Table 1.

There were significant ($P<0.05$) differences among the different treatment groups in all the considered semen quality parameters. Significant ($P<0.05$) increase in the spermatozoa concentrations, sperm progressive motility, percentage live sperm cell, and sperm count were recorded in the cocks fed T2 (2g) and T3 (4g) diets. At and above the level of 6g/kg diet ($\geq 6g$), there was a significant ($P<0.05$) decline (in a progressive manner) in the semen volume, sperm. Conc., progressive sperm motility, and percentage normal sperm cells compared to the control. The values obtained for sperm concentration, sperm motility, percentage live

sperm cells, and percentage normal sperm cells were highest for cocks in T3 while cocks in T5 had the least values of semen volume, Sperm concentration, percentage live sperm cells, percentage normal sperm cells, and total sperm cells per ejaculate (0.27 ± 0.01 , 4.08 ± 0.24 , 52.67 ± 0.99 , 41.66 ± 1.89 , and 0.73 ± 0.06 respectively).

The findings of this study are in agreement with those of Oguike and Archibong (2011) and Woode *et al.* (2011) who observed an increase in testicular weight, improved sperm count and sperm motility in male rabbits and rats respectively when treated with *X. aethiopica* fruit extract up to 300mg/kg body weight. Similarly, Ahmed (2011) reported that Quails fed Fenugreek seed meal up to the levels of 15g/kg diet showed a progressive increase in semen volume, sperm concentration, and sperm motility. However, the result of the present study was not consistent with the reports of Uyovwiesevwa *et al.* (2011); Woode *et al.* (2011) and Nnodim *et al.* (2012) who reported a dose dependent decrease in sperm count, sperm motility, and viability in rats. The improved semen quality observed for the cocks on 4% XASM could be attributed to the anti-oxidative properties of *X. aethiopica*. *X. aethiopica* contains bioactive components such as polyphenols that can reduce oxidative stress and modulate harmful biological pathways (Uyovwiesevwa *et al.*, 2011).

The result of the effect of XAFM on the haematology of Nigerian local cocks are presented in Table 2. The result showed that there were no significant difference ($P > 0.05$) in the haematological indices of packed cell volume, red blood cells, white blood cell, haemoglobin, neutrophils, and lymphocytes.

Result showed that the mean hematological characteristics did not differ significantly ($P > 0.05$) among treatment groups. This shows that *X. aethiopica* does not interfere with the physiological status of the animals as evident in the blood hematology. The results of this study is consistent with those of Taiwo *et al.* (2009) and Abaidoo *et al.* (2011) who reported that the PCV, RBC, Neutrophils, and lymphocytes did not differ in rats treated with *X. aethiopica* extracts up to 300mg/kg body weight when compared with untreated rats. However, these

authors reported higher values for hemoglobin and white blood cells at higher levels of the extracts. Increase in these two hematological parameters was attributed by Abaidoo *et al.* (2011) to the direct effect of the extract on haemopoiesis in animals. Also, decoction of dry fruits of *X. aethiopica* has been reportedly to boost immunity and this could be the reason for the higher values of white blood cells reported by Abaidoo *et al.* (2011).

CONCLUSION

Contrary to several previous studies and the assertion that *X. aethiopica* is an anti-fertility spice, it was concluded from this study that a minimal dietary inclusion (up to 4g/kg diet) improves semen quality and reproductive performance in cocks and hence can be beneficial to local chicken production.

REFERENCES

- Abaidoo, C.S., Woode, W. and Alhassan, A., 2011. An evaluation of the effect of ethanolic fruit extracts of *Xylopiia aethiopica* on haematological and biochemical parameters in male rats, *Der Pharmacia Sinica*, 2(2), 39-45.
- Adienbo, O.M., Nwafor, A. and Ogbomade, R.S., 2013. Effect of hydro-methanolic extract of *Xylopiiaaethiopica* on sexual behaviour in male wister rats, *International Journal of Advance Biological and Biomedical Research*, 1(9), 1078-1085
- Ahmed, T.T., 2011. Effect of Dietary Supplementation with Different Levels of Fenugreek Seeds (*Trigonella Foenum Graecum*) On Semen Quality and Histological Testis Traits of Japanese Quail (*Coturnix coturnix japonica*), *Diyala Agricultural Science Journal*, 3(1), 1-9
- Ajayi, M.T., 2010. Nigeria Indigenous chicken: A Valuable genetic resource for meat and egg production, *Asian Journal of Poultry Science*, 4, 164-172
- Duncan, D.B., 1955. Multiple range and multiple F tests, *Biometrics*, 11, 1-42.
- Ezekwesili, C.N., Nwodo, O.F.C., Eneh, F.U. and Ogbunugafor, H.A., 2010. Investigation of the chemical composition and biological activity of *Xylopiia aethiopica* Dunal

- (Annonaceae), *African Journal of Biotechnology*, 9(43), 7352-7356
- Food and Agricultural Organization (FAO), 2014. The state of the worlds' animal genetic resources for Food and Agricultural Organization Rome, Italy.
- Hafez. E.S.E., 1978. Reproduction in Farm Animals. 2nd Edn., Education Page. Lea and Febiger, Philadelphia,
- Machebe, N.S. and A.G. Ezekwe, 2004. Ejaculate characteristics of three genotypes of local cocks in the humid tropics. *J. Trop. Agric. Food, Environ. Ext.*, 3(2): 33-37.
- Muanya, C., 2008. How plants can induce labour, heal after-birth wounds. The Guardian Newspaper. 17th Jan. 2008.
- Ndukwu, B.C. and Ben-Nwadibia, N.B., 2005. Ethnomedicinal aspects of plants used as spices and condiments in the Niger Delta Area of Nigeria, *Ethnobotany* leaflets, 1 (10), Available at: <http://opensiuc.lib.siu.edu/eb/vol2005/iss1/10>.
- Nnodim, J., Nwanjo, H.U., Nwosu, D. and Uche, U., 2012. The Effect of *XylopiA Aethiopica* Fruits Extract on the Sperm Production and Testicular Oxidative Status in Male Wistar Rats. *Global Journal of Medicinal Plant Research*, 1(1), 22-25
- Oguike, M. A. and Archibong, C. B., 2011. Effect of Ethiopian Pepper (*XylopiA aethiopica*) on the testis and semen quality of rabbit bucks, *Journal of Advances in Development and Research*, 2, 294-298.
- Onyebuagu P.C., 2013. Assessment of the effect of *XylopiA aethiopica* on reproductive performance in Wistar rats, (unpublished PhD thesis, Delta State University, Abraka, Nigeria)
- Peters, S.O., Shoyebo, O.D., Ilori, B.M., Ozoje, M.O., Ikeobi, C.O.N. and Adebambo, O.A., 2008. Semen quality traits of seven strains of chickens raised in the humid tropics, *International Journal of Poultry Science*, 7(10), 949-953
- pp: 237.
- Somova, L.I., Shode, F.O., Moodley, K., and Govender, Y., 2001. *Journal of Ethnopharmacology*, 77 (2-3):165-174.
- SPSS, 2010. Statistical Package for Social Sciences, (SPSS Incorporation, 444 Michigan Avenue, Chicago, IL60611, USA)
- Taiwo, I.A., Oboh, B.O. and Francis-Garuba, P.N., 2009. Haematological Properties of Aqueous Extracts of *Phyllanthus amarus* (Schum and Thonn.) and *XylopiA aethiopica* (Dunal) A. Rich in Albino Rats, *Ethno-Medicine*, 3(2), 99-103.
- Uyovwieseewa, A.J., Aloamaka, P.C. and Avwioro, O.G., 2011. Effect Of *XylopiA Aethiopica* Plant Extract On Semen Quality Of The Sprague Dawley Rats, *International Journal of Recent Scientific Research* 2(6), 179 – 181
- Woode, E., Alhassan, A. and Abaidoo, C.S., 2011. Effect of ethanolic fruit extract of *XylopiA aethiopica* on reproductive function of male rats, *International Journal of Pharmaceutical and Biomedical Research*, 2(3), 161-165

Table 1: Effect of Ethiopian pepper fruit meal on the semen characteristics of Nigerian light-ecotype local chicken

Parameters	Levels of EPFM per kg diet					Sig
	0g	2g	4g	6g	8g	
Volume (ml)	0.31±0.01 ^a	0.34±0.01 ^a	0.29±0.02 ^b	0.18±0.01 ^c	0.27±0.01 ^b	0.00*
Concentration (x 10 ⁶ /ml)	4.09±0.39 ^c	4.77±0.57 ^b	5.07±0.22 ^a	4.21±0.45 ^b	4.08±0.24 ^c	0.00*
Motility (%)	62.33±1.09 ^c	85.33±0.67 ^b	97.33±1.61 ^a	55.33±1.41 ^d	55.67±0.95 ^d	0.00*
Live sperm. (%)	63.33±1.21 ^c	76.33±0.95 ^b	88.17±1.38 ^a	53.00±0.86 ^d	52.67±0.99 ^d	0.00*
Dead sperm. (%)	36.33±1.09 ^b	23.67±1.09 ^c	11.67±1.41 ^d	46.33±1.41 ^a	48.00±1.46 ^a	0.00*
Normal sperm. (%)	71.33±0.84 ^b	74.67±1.12 ^b	83.67±1.20 ^a	71.00±1.24 ^b	57.60±1.77 ^c	0.00*
Abnormal sperm. (%)	29.00±0.68 ^b	25.33±1.12 ^b	17.33±1.52 ^c	28.66±1.23 ^b	41.66±1.89 ^a	0.00*
Total sperm. (x 10 ⁹ /ejac.)	1.28±0.05 ^b	1.61±0.06 ^a	1.44±0.11 ^{ab}	0.87±0.03 ^c	0.73±0.06 ^c	0.00*

Means±SEM in the same row with different superscripts differ significantly (p < 0.05); Sperm: Spermatozoa; ejac: ejaculation; Sig: Significance; * Significant.

Table 2: Effect of *Xylopia aethiopica* fruit meal on haematological characteristics of Nigerian light ecotype local cocks.

Parameters	0g EPFM/kg Diet	2g EPFM/kg Diet	4g EPFM/kg Diet	6g EPFM/kg Diet	8g EPFM/kg Diet	Sig
PCV (%)	35.00±1.00	37.00±1.00	38.00±1.00	37.00±1.00	37.00±1.00	0.41 ^{NS}
RBC (x10 ⁶ /ml)	11.17±0.55	11.16±0.52	11.80±0.12	11.80±0.13	11.46±0.47	0.54 ^{NS}
WBC (10mm ³)	10800±400	11000±400.00	11200±100.00	11600±200.00	11300±450.00	0.56 ^{NS}
HB (g/dl)	10.30±0.20	10.70±0.00	10.80±0.10	11.20±0.00	11.35±0.45	0.10 ^{NS}
NEUT (%)	24.00±6.00	18.50±2.50	20.00±0.00	29.00±1.00	29.50±0.50	0.14 ^{NS}
LYM (%)	74.00±6.00	80.00±2.00	78.50±0.50	70.00±0.00	70.00±0.00	0.15 ^{NS}

Sig: Significance; NS = Not significant (P>0.05); PCV: Packed cell volume; RBC: Red blood cell; WBC: White blood cell; HB: Haemoglobin; NEUT: Neutrophils; LYM: Lymphocytes.