SEMEN CHARACTERISTICS OF COCKS FED VARYING LEVELS OF TUMERIC POWDER AS SUPPLEMENT

Amao*[1], E. A., Amao[2], O. D., Buzari[1], Z. O., Adelegan[1,] T. M., Tiamiyu,[1]W. A. and Yunus, M. O.
[1]Department of Animal Production and Technology, The Oke-Ogun Polytechnic, P.M.B 021 Saki (TOPS), Oyo State, Nigeria.
[2]National biotechnology Development Agency, Bio-resources Development Centre, Ilorin, Kwara State, Nigeria.
Corresponding author, amaoemmanuelayodeleamao@gmail.com/+2348059529136

ABSTRACT
Emerging evidence from in vivo as well as in vitro studies indicates that botanicals play noteworthy roles in the treatment, prevention and management of diseases. Use of natural compounds in botanicals has been proposed as potential alternative to conventional therapeutic options. Therefore, this study aimed to evaluate the effect of varying levels of turmeric powder (Curcuma longa) on semen characteristics and haematological indices of cocks. The experimental material was drenched at 0.0g (T1), 0.05g (T2), 1.00g (T3) and 1.5g (T4) after 2 weeks of acclimatization. Semen volume, sperm cell progressive motility, sperm cell liveability, acrosome integrity, sperm cell concentration and normal sperm cell were evaluated for semen characteristics. Data obtained were subjected to one-way analysis of variance. Semen volume (0.34 – 0.37mL), sperm cell progressive motility (68.33 – 80%), sperm cell liveability (46.66 – 85.00%), acrosome integrity (50.00 – 85%) and normal sperm cell (66.66 – 90%) shows significant difference (P<0.05) in favour of cocks on higher level of turmeric powder. While sperm cell concentration (28.33 - 40.00 X109/mL) shows no significant difference (P>0.05). Turmeric powder up to 1.50g shows no negative effect on the semen characteristics of cocks.

Keywords: semen volume, liveability, turmeric powder, normal sperm cell.

INTRODUCTION

Infertility is one of the major concerns in poultry breeding with roughly 30% of the complications is male related (Barkhordari *et al*., 2013). Effective production of chicks is reliant on the potency and reproductive performance of the cock, which is determined to a great extent by the excellence of the semen it produces (Ilori *et al*., 2012). Conversely, the conservation of fertility in breeder cocks over the years has been difficult predominantly in the humid tropics (Okoro *et al.,* 2016). In these tropical regions, undeviating meteorological factors such as high ambient temperature and high relative humidity (which Results in severe heat stress), in addition to other factors such as age, poor nutrition, and management, unfavourably affect semen production capacity of cocks (Ayo *et al*., 2011). The chicken spermatozoa are known to own distinctive structural and chemical configurations. Polyunsaturated fatty acids are indispensable constituents of avian spermatozoa which play a major role both in maintaining the physical properties and roles of the spermatozoa and in sperm-egg fusion (Khan *et al*., 2011). This high level of polyunsaturated fatty acids existent in the chicken spermatozoa predisposes them to per-oxidative impairment and associated spermatozoa dysfunction. Therefore, lipid peroxidation constitutes the chief cause of infertility in males (Zaniboni *et al*., 2006) and its effects can be enhanced by the antioxidant system (Słowinska *et al*., 2011). Naturally, sperm cells are secured from oxidative harms by several enzymatic and non-enzymatic anti-oxidant defence mechanisms. The use of artificial antioxidants in animal production to improve health, performance, and product quality has been dispirited due to their potential adverse effects (Lin *et al*., 2016). Recent studies on the use of natural antioxidants of plant derivation (such as flavonoids and other polyphenolic compounds) in animal production have purportedly improved productivity and enhanced endogenous antioxidant system (Lee *et al*., 2013). Turmeric *(Curcuma longa)* is a tropical plant native of Southern and South-eastern tropical Asia. The main yellow bio active substances isolated from the rhizomes of curcuma are *Curcumin demothoxycurcumin* and *Bisdemethoxy curcumin* which is present to the extent of 2-5% of the total spice in turmeric. Curcumin is the main important bio-active constituent responsible for the biological activity of turmeric. Curcumin possesses many beneficial biological activities, e.g., anticancer, anti-inflammatory, antimicrobial, antiviral, antifungal, and

antioxidant activity (Aggarwal *et al.,* 2007). Curcumin hunts oxygen free radicals and prevent lipid peroxidation in membranes (Kuhad *et al.,* 2007). It is, therefore, useful for the treatment of many diseases, such as cardiovascular disorders (Manikandan *et al.,* 2004) and reproductive issues (Glombik *et al.,* 2014). Effects of turmeric on sperm motility and viability in roosters are however unclear.

MATERIALS AND METHODS

Procurement and Preparation of Test Ingredient

Turmeric (*C. longa*) was obtained from Sango market in Saki in Oyo State, Nigeria, in March 2023. The rhizomes were washed, its skin scraped and air-dried for about 10 h, and further oven-dried at 40◦C for 12 h. afterwards, the dried turmeric were ground into powder using a blender. The product was kept in an air-tight container until the period of usage.

Management of Experimental Animals and Semen Collection and Evaluation

A total of 60 sexually matured and healthy light ecotype genotypes of Nigerian local cocks, sample population of similar age, size, and body weight ranges (between 1.5 and 1.8 kg) used for the study were obtained from the Department of Animal Production Technology Teaching and Research Farm, The Oke - Ogun Polytechnic, Saki. The birds were randomly allotted into 4 treatments (T) groups: birds in T1 were drenched 0.00g TP and this served as control group birds in T2, T3, and T4 were drenched 0.50, 1.00 and 1.50g TP respectively. Each treatment had 15 cocks and were replicated 3 times with 5 birds per replicate. The birds were reared and managed intensively in cage housing system and were observed and acclimatized for 2 weeks before the commencement of the study. During the 2 weeks acclimation period, the birds were trained for semen collection. Drenching of experimental material commenced at the end of the acclimation period. Feed and water were given to the birds *ad libitum.* Semen collection and evaluation were carried out for a period of 8 weeks. Semen was collected by abdominal massage techniques (Hafez, 1978). Semen collection was done twice a week on Mondays and Thursday between 07:0 3am and 10:00 am. The birds responded to massage by partially averting their cloaca, and semen was collected from the ventral lip of the vents in calibrated tubes maintained at 35◦C using insulated jackets. Individual ejaculates were collected into a 4 mL graduated collection tube, and ejaculate volumes were read to the nearest 0.1mL. Following semen collection, the semen was maintained in a 35◦C water bath for sperm motility assessment. The physical semen characteristics were analysed as described previously Peters *et al*., (2008). For the sperm motility, a drop of semen was placed on a microscope slide using a rubber micropipette and then covered with a glass cover slip to spread the semen uniformly on the slide. The slides were placed under a microscope for observation (×400 magnification). Several microscopic fields were examined for each sample. Motility was expressed as a percentage of the cells that are motile within the observed area. The sperm concentration was measured with an improved Neubauer haemocytometer using a direct cell count method. The haemocytometer consists of specially designed slides that contains 2 counting chambers and 2 dilution pipettes. The counting chambers are 0.1 mm in depth and have an area of 1.0 mm^2. The squares are further sub-divided into 25 smaller squares. One milliliter of the semen was diluted with 0.9 normal saline at the rate of 1:250. The cover slip was moistened with water and affixed to the haemocytometer to enable adhesion. A drop of the diluted semen was placed at both ends of the haemocytometer and allowed to settle. The loaded haemocytometer was then placed under the microscope for observation (×400 magnification). Cells which have their heads within the subdivided smaller squares at the 4 edges and the centre of the haemocytometer were counted and the average taken for a bird. The sperm concentration was calculated using the formula: C = 50, 000 × N × D where C = concentration of semen per volume (ml), N = Number of spermatozoa counted, D = dilution rate (Uzochukwu *et al*., 2019). Total spermatozoa were calculated as the concentration of sperm cell in the total volume of ejaculate collected from a cock. The sperm vitality was determined by placing a drop of semen on a microscope slide with a micropipette, and a drop of eosin-nigrosine stain was added, smeared, immediately air-dried, and viewed under a microscope (×400 magnification). The proportions of live (eosin-impermeable) and dead (eosin-permeable) spermatozoa in a sample were assessed on the basis of 200 counted cells. Percentage normal cells were determined as the percentage of cells with intact and normal morphological features.

Statistical Analysis

At the end of the field trial, data were analysed in accordance with one-way analysis of variance (ANOVA) in completely randomized design (CRD) using SAS computer analytical package and means were separated with Duncan multiple range test of the same software.

RESULTS AND DISCUSSION

Table 1 shows result of semen characteristics of cock drenched varying level of Turmeric powder (TP). There exist significant difference, ($P<0.05$) across the treatment with semen volume ranging from 0.34 mL in the control to 0.37 mL on 1.5g TP. The result shows a progressive increase in the semen volume with the increase level of turmeric powder. The result deviates from the report of Uzochuwku *et al*., (2019) who report decrease in semen volume of cocks with increased level of Ethiopian pepper fruit meal, though the value obtained (0.34 - 0.37mL) in this work is greater than the value (0.18 - 0.34mL) reported by Uzochuwku *et al*., (2019). Sperm cell progressive motility shows significant difference ($P<0.05$) with 0.5gTP having the lowest value of 68.33%, followed by control (80%) while 1.0gTp and 1.5gTp had similar sperm progressive motility value of 83.33% and 91.66% respectively. This result corroborates the findings of Victor *et al*., (2016) who reported increase in progressive motility of cocks with increased levels of onions and garlic mixture. Sperm cell liveability showed significant difference across the treatment ($P<0.05$) with values ranging from 46.66 - 85.00%. It shows the same trend as sperm cell motility. Sperm cell liveability showed decrease value (46.66%) in 0.5gTP while the result of other treatments showed similar result, though the value of control is numerically higher than 1.0gTP and 1.5gTP, nevertheless 1.0gTP and 1.5gTP compete favourably with the control. Acrosome integrity revealed significant difference ($P<0.05$) across the treatment and shows the same trend with sperm liveability. Acrosome integrity value was lowered in 0.5gTP and had higher value in 1.0gTP and 1.5g TP that compete favourably with the control. The result showed that the acrosome in 1.0gTP and 1.5gTP were well protected compared to that of the control. There exist no significant difference in sperm cell concentration ($P>0.05$) with values ranging from 28.33 - 40.00 ($x10^9$/mL), since the result is statistically similar turmeric powder had no detrimental effect on sperm cell concentration. This result deviates from the report of Victor *et al*., (2016) who affirmed significant difference in sperm cell concentration of cocks fed mixture of onion and garlic. Normal sperm cell was higher in 1.0gTP and 1.5gTP which competes favourably with the control while normal sperm cell was lowered in 0.5gTP. Table 2 shows the haematological result of cocks drenched with varying level of turmeric powder.

Table 1: Semen characteristics of Cocks drenched with varying levels of Turmeric Powder

Parameters	0.00g TP	0.50g TP	1.00g TP	1.50g TP	SEM
Semen volume (mL)	0.34^b	0.36^a	0.37^a	0.37^a	0.00
Sperm progressive motility (%)	80.00^b	68.33^c	83.33^a	91.66^a	17.30
Sperm livability (%)	90.00^a	46.66^b	85.00^a	76.66^a	15.90
Acrosome integrity (%)	83.33^a	50.00^b	85.00^a	76.66^a	4.71
Sperm concentration (x 10^8 mL^{-1})	40.00	31.33	28.33	33. 33	72.25
Normal sperm cell (%)	83.33^a	66.66^b	83.33^a	90.00^a	9.38

a, b, c means with different superscript within a row are significantly different

CONCLUSION

From the result of this work it is concluded that drenching cocks with turmeric powder (*Curcuma longa*) up to 1.5g as supplement, had no significant effect on the haematology of the cocks, also there is an improvement in semen characteristics such as semen volume, sperm cell liveability, Acrosome integrity and normal sperm cells. It is therefore suggested that further research is needed with more emphasis on large sample size and higher turmeric powder levels to better understand the effect of turmeric powder on cock semen characteristics and their haematological indices.

REFERENCES

Aggarwal B.B., Sundaram, C., Malani, N. & Ichikawa, H., (2007). Curcumin: the Indian solid gold. Adv. Exp. Med. Biol. 595, 1-75.

Ayo J. O., Obidi, I. J. A. & Rekwot, P. I. (2011). Effects of heat stress on the well-being, fertility, and hatchability of chickens in the northern guinea savannah zone of Nigeria: a review. ISRN Vet. Sci.

Barkhordari, A., S. Hetmatimoghaddam, M. A. Ajebali, T. A. Khalili, & M. Noorani. (2013). Effect of zinc oxide nanoparticle on viability of human spermatozoa. Iran. J. Reprod. Med. 11:767–771.

Cray, C. & Zaias, J. (2004). *Laboratory procedures, Veterinary Clinical Exotic Animal Practice,* 7(2), 487- 518.

Fudge, A. M. (2000). Avian complete blood count. Laboratory Medicine: Avian and Exotic Pets. Philadelphia, PA: WB Saunders, 16, 9-18.

Glombik, K., Basta-Kaim, A., Sikora-Polaczek, M., Kubera, M., Starowicz, G. & Styrna, J., (2014). Curcumin influences semen quality parameters and reverses the di (2-ethylhexyl) phthalate (DEHP) - induced testicular damage in mice. *Pharmacol. Rep*. 66, 782-787.

Hafez, E. S. E. (1987). Reproduction in Farm Animals. 5th ed. Lea & Febiger, Philadelphia

Ilori, B. M., C. E. Isidahomen, & K. Akano. (2012). Effect of ambient temperature on reproductive and physiological traits of Nigerian indigenous chickens. *J. Anim. Prod. Adv*. 2:477–489.

Khan, R. U., Z. Nikousefat, M. Javdani, V. Tufarelli, & V. Laudadio. (2011). Zinc-induced moulting: production and physiology. *Worlds Poult. Sci.* J. 67:497–506

Kuhad, A., Pilkhwal, S., Sharma, S., Tirkey, N., & Chopra, K., (2007). Effect of curcumin on inflammation and oxidative stress in cisplatin-induced experimental nephrotoxicity. *J. Agric. Food Chem.* 55, 10150-10155.

Lee, B., Jung, J. & Kim, H. (2012). Assessment of red onion on antioxidant activity in rat. *Food Chem. Toxicol*. 50:3912–3919.

Lin, M. J., Chang, S. C., Jea, Y. S., Liao, J. W., Fan, Y. K., & Lee, T. T. (2016). In vitro antioxidant capability and performance assessment of White Roman goose supplemented with dried Toona sinensis. *J. Appl. Anim. Res*. 44:395–402.

Manikandan, P., Sumitra, M., Aishwarya, S., Manohar, B.M., Lokanadam, B., & Puvanakrishnan, R., (2004). Curcumin modulates free radical quenching in myocardial ischaemia in rats. Int. J. Biochem. *Cell Biol.* 36, 1967-1980.

Morris, M.W., Davey, F.R. & Henry, J.B. (2001). Basic Examination of Blood. *Clinical Diagnosis and Management by Laboratory Method*, 20, 479 - 519.

Okoro, V. M. O., Mbajiorgu, C. A. & Mbajiorgu, E. F. (2016). Semen quality characteristics of Koekoek breeder cocks influenced by supplemental inclusion levels of onion and garlic mixture at 35-41 weeks of age. *R. Bras. Zootec*. 45:433–440.

Paul, M.E., Kolawole, D.A. & Glory, E.E. (2020). Growth Performance, Carcass Quality, Organ Weights and Haematology of Broilers Fed Graded Dietary Levels of Turmeric (*Curcuma longa* L.) Powder as Feed Additive. Animal and Veterinary Sciences. Special Issue: Promoting Animal and *Veterinary Science Research,* 8(3), 65 - 70.

Peters, S. O., Shoyebo, O. D. Ori, B. M., Ozoje, M. O. Ikeobi, C. O. N & Adebambo, O. A. (2008). Semen quality traits of seven strain of chickens raised in the humid tropics. *Int. J. Poult. Sci*. 7:949–953.

Słowinska, M., J. Jankowski, G. J. Dietrich, H. Karol, ´ E. Liszewska, J. Glogowski, K. Kozlowski, K. Sartowska, & A. Ciereszko. (2011). Effect of organic and inorganic forms of selenium in diets on turkey semen quality. *Poult. Sci*. 90:181–190.

Uzochukwu, I. E. B. C. Amaefule, C. N. Aba, N. W. Nnajiofor, N. S. Machebe, & H. N. Foleng (2019). Semen Characteristics and Hematology of Nigerian Local Cocks Fed Varying Dietary Levels of Ethiopian Pepper Fruit Meal. *J. Appl. Poult. Res.* 28:1106–1114.

Zaniboni, L., R. Rizzi, and S. Cerolini. (2006). Combined effect of DHA & alpha - tocopherol enrichment on sperm quality and fertility in the turkey. *Theriogenology* 65:1813 – 1827.