Short Communication

The effect of crude oil contaminated feed on semen characteristics of cocks

I. Udeh; F. U. C. Mmereole, I. Bratte and M. Oritseserundede

Department of Animal Science and fisheries, Delta State University, Asaba Campus, Asaba, Nigeria.

Abstract

Data from 32 Isa Brown (layer type) cocks aged 10 months were used to determine the effect of crude oil contaminated feed on their semen quality. There were four treatment groups with two replicates each. Treatment T_1 which received crude oil free diet served as control. Treatments T_2 , T_3 and T_4 received crude oil contaminated feed at the rate of 1.0ml, 2.0ml and 3.0ml per kg of feed, respectively. Both feed and water were provided ad libitum. The experiment lasted for five weeks during which each cock ejaculated two times a week using the massage technique. The results indicated a highly significant ($P < 0.01$) decrease in semen volume from treatments T_1 to T_4 while significant ($P < 0.05$) decreases in sperm concentration and sperm motility were observed from treatments T_1 to T_4 . Results also showed a significant ($P < 0.05$) increase in percentage dead sperm and total abnormal sperm from treatments T_1 to T_4 . The effect of weeks was significant on body weight, semen volume, sperm concentration and percentage dead sperm. Treatment by week interaction was significant ($P < 0.05$) only on body weight. It was concluded that crude oil contaminated poultry feed had a deleterious effect on semen quality of cocks.

Key words: Crude oil, Cocks, Contamination, Semen.

Introduction

Crude oil exploration is the mainstay of Nigeria economy and constitutes about 90% of foreign exchange earning of the nation (Shore and Douben, 1994). Apart from the financial benefits, the exploration of crude oil brings about the pollution of the environment including water ways (rivers and streams). Hence, crude oil exposure presents a potential hazard to both aquatic and terrestrial species (Shore and Douben, 1994). Generally, crude oil gets to the terrestrial and aquatic ecosystems as a consequence of spillage arising from natural seepages, offshore exploration, leakage from oil wells or from oil tankers, accidents from oil tankers, land based discharges and sabotage (Awobajo, 1981). Crude

oil is toxic to both plants and animal species (Ovuru *et al.*, 2004). The toxic effects is as a result of the presence of a high level of hydrocarbons especially aromatics hydrocarbons (Da-Silva *et al.*, 1997). Experimental evident has shown that exposure of rabbits to crude oil contaminated feed and forages retarded their attainment of puberty (Nodu *et al.*, 2005) and increased their mortality rate (Ovuru and Orwari, 2005). Wekhe and Okere (2006) also observed hyperemia, vascular dilation and progressive necrosis in the liver as well as reduced spermatogenesis followed by degeneration of the basal cells of seminiferous tubules of the cockerel's testes following exposure to crude oil contaminated feed. The objective of this study was to test the effect of crude oil con-

taminated feed on semen characteristics of cocks.

Materials and Methods

Location of the study and sourcing of crude oil.

The study was carried out at the Poultry Unit of the Department of Animal Science and Fisheries, Faculty of Agriculture, Delta State University, Asaba Campus. Asaba is located between 60° 45' East and 6° 12' North. Annual rainfall in Asaba ranges from 1800mm–3000mm while maximum day temperature ranges from 27.5°C–30.9°C (Federal Ministry of Aviation; Department of meteorological services Asaba, 2006). A pre-experimental period of two weeks was observed while the actual study lasted for five weeks. The two weeks pre-experimental period was used in training the cocks for semen collection using the massage technique (Burrows and Quinn, 1937). The crude oil used for the study was obtained from Shell Petroleum Development Company Port-Harcourt, with permission from the Department of Petroleum Resources, NNPC, Lagos, Nigeria. The crude oil was stored in a clean container until required for the study.

Management of the experimental animals.

Thirty-two layer type cocks of Isa Brown strain, aged 10 months with an average weight of 2.50kg were used for the study. The cocks were sourced from a reputable farm in Asaba, Delta State. The cocks were housed on deep litter pens. They were fed *ad libitum* on commercial broiler finisher ration containing about 20% crude protein. Clean drinking water was also provided to the cocks *ad libitum*. Vitalyte, a vitamin supplement was administered to the birds through drinking water four times a week to enhance productivity. Other routine management operations including cleaning the poultry house, washing the drinkers and the feeders were also carried out. The thirty-two cocks were divided into four equal numbers and randomly assigned to four treatment groups

namely T₁, T₂, T₃, and T₄. Each treatment group was replicated twice with four cocks per replicate. Treatment T₁ which received crude oil free feed, served as the control. Treatments T₂, T₃ and T₄ were fed with varying levels of crude oil contaminated feed, such that T₂ cocks received crude oil contaminated feed at the rate of 1 ml per kg of feed served, T₃ cocks, 2 ml per kg of feed served, while T₄ cocks, received 3ml per kg of feed served. The bodyweight of each cock was taken immediately after semen collection by means of a sensitive weighing balance. It was not taken prior to milking in order not to disturb the cock which might effect semen yield.

Semen collection and evaluation

Semen collection was done between 8am to 10am on Mondays and Thursdays consistently for five weeks. Semen was collected by the manual massage technique (Burrow and Quinn, 1937). Clean, small test tubes were used in the collection of the semen and samples were evaluated within 6 minutes after collection. The colour and consistency of the semen samples were evaluated using the criteria outlined by Omeje and Marire (1990). Semen volume was determined by drawing the semen with tuberculin syringe of 1.0ml capacity and reading directly to the nearest 0.01 ml. Gross motility (wave pattern) was determined by examining a drop of raw, undiluted semen on a prewarmed slide under light microscope as described by Ekpenong (1983). Progressive sperm motility was evaluated at x 40 and scored 0–90% with 0 representing no progressive motility. Sperm concentration was determined using haemocytometer in a method described by Ekpeyong (1983). The percentage live and dead sperm and morphologically abnormal sperm were determined using eosin-nigrosin vital staining technique (Marini and Goodman, 1969). The pH value of the semen was determined using a pH indicator paper with a measuring range of 1–13.

Data analysis

All the data generated were subjected to two factors analysis of variance in a completely randomized design according to the procedure by Steel and Torrie (1980). Statistically significant mean values of the treatment groups with regard to each semen trait were separated by means of the Duncan's Multiple Range Test (Duncan, 1955).

Results and Discussion

Table 1 presents the mean square values for body weight and semen characteristics of cocks fed varying levels of crude oil contaminated feed. The effect of treatment was highly significant ($P<0.01$) on semen volume and significant ($P<0.05$) on sperm motility, sperm concentration, percentage dead sperm and total abnormal sperm. The

effect of weeks was highly significant ($P<0.01$) on body weight and significant ($P<0.05$) on semen volume, sperm concentration and percentage dead sperm. Treatment by week interaction was significant ($P<0.05$) only on bodyweight. Table 2 presents the effect of different levels of crude oil contaminated feed on semen characteristics of cocks. Treatment T₁ which received crude oil free feed gave the highest volume of semen and the highest number of sperm concentration per ejaculate. This was followed by treatment T₂, T₃ and T₄ in that order. This means that crude oil exposure to the level of 1.0 – 3.0ml per kg of feed can cause a significant decrease in semen production of cocks. This decrease may be associated with the toxic effect of crude oil on the vital organs of the cocks (Nodu *et al*, 2005).

Table 1: Mean square values for the effect of feeding crude oil contaminated feeds on bodyweight and semen characteristics of cocks

Sources of variation	DF	Body weight	Semen volume	Semen motility	Semen pH	Sperm Concent	Dead sperm	Abnormal sperm
Treatment	3	0.02 ^{NS}	0.11**	4890.00*	21.00 ^{NS}	63103.03*	151.53*	56.58*
Weeks	4	0.49**	0.07*	1258.13 ^{NS}	11.64 ^{NS}	62135.58*	142.70*	12.08 ^{NS}
Treatment x weeks	12	0.05*	0.02 ^{NS}	547.29 ^{NS}	6.34 ^{NS}	10381.40 ^{NS}	40.12 ^{NS}	21.51 ^{NS}
Error.	60	0.02	0.01	1194.17	12.31	24371.10	54.35	14.75

* $P<0.05$ ** $P<0.01$ NS=Not significant

Table 2: Effect of crude oil contaminated feed on semen characteristics of layer type cocks

Semen traits	Treatment groups				Significant level
	T1	T2	T3	T4	
Semen volume (ml)	0.21±0.04 ^a	0.12±0.03 ^b	0.09±0.02 ^{bc}	0.03±0.01 ^c	$P<0.01$
Sperm Motility (%)	52.50±7.43 ^a	45.00±7.63 ^b	28.50±7.58 ^{bc}	18.00±6.94 ^c	$P<0.05$
Semen pH	7.10±1.82	7.23±0.77	7.45±0.74	7.20±0.68	NS
Sperm concentration (X 10 ⁶)	107.70±6.36 ^a	94.90±4.83 ^b	92.65±8.96 ^b	69.35±10.31 ^c	$P<0.05$
Dead sperm (%)	3.20±1.65 ^b	5.00±1.44 ^{ab}	6.40±1.52 ^a	7.20±2.07 ^a	$P<0.05$
Abnormal sperm (%)	1.25±0.44 ^b	3.60±0.93 ^{ab}	4.35±1.12 ^a	5.15±0.91 ^a	$P<0.05$

a,b,c. Means on the same row with different superscripts are significantly different ($P<0.01$); ($P<0.05$).

This result is in line with the report of Wekhe and Okere (2006) that crude oil exposure to a level of 5.0 – 10.0ml per litre of water reduced spermatogenesis in the domestic cocks. According to the authors, the reduction in spermatogenesis was as a result of the degeneration of the basal cells of the seminiferous tubules of the cocks' testes. A significant ($P < 0.05$) decrease in sperm motility of cocks was observed from treatment T_1 to T_4 as a result of feeding crude oil contaminated feed. Since sperm motility is a very good indicator of semen quality and fertilizing ability (Kammerer *et al.*, 1972 and Etches, 1996), it follows that crude oil contaminated feed can lead to a decrease in the fertilizing capacity of cocks. The results further showed a significant ($P < 0.05$) increase in percentage dead sperm and total abnormal sperm from treatments T_1 to T_4 , thus implying that spermatozoa integrity were adversely affected when cocks were fed crude oil contaminated feed. The colour and consistency of ejaculates recorded across the four treatment groups were within the range of normal colour of cocks semen which is pearly white or milky and thick (Etches, 1996). Similarly, the PH value of semen observed among the treatment groups were within the range of the normal pH of cock semen which is 7.00 – 7.50 (Omeje and Marire, 1990).

Conclusion

This study has demonstrated that contamination of poultry feed with crude oil will adversely affect the semen producing ability of the cocks. Therefore urgent steps should be taken to control oil pollution in the Nigeria Delta region to protect both aquatic and terrestrial life in the area.

Acknowledgement

The authors are grateful to Chief P. I. Odili for the laboratory evaluation of the semen samples and the provision of most of the materials used for this research.

References

- Awobajo, S. A (1981). An analysis of oil spill accidents in Nigeria: 1976 – 1980. In proceedings of the petroleum industry and the Nigeria environment Nov. 19-22, 1981. NNPC, PTI Warri, Nigeria pp 89 – 94.
- Burrows, W. H. and Quinn, J. P. (1937). The collection of spermatozoa from the domestic fowl and turkey. *Poultry Sci.* 16: 19-24.
- Da-Silva, E. M.; Peso-Aguitor, M; Navaro, M.D.T. and Chastinent, C. A. (1997). Impact of petroleum pollution on aquatic coastal ecosystems in Brazil. *Environ. Toxicol. Chem.* 16: 112-118.
- Duncan, D. B. (1955). Multiple range and Multiple F-tests. *Biometrics* 11:1-42.
- Ekpenyong, I. J. (1983). *Semen examination. In Manual on Veterinary Clinical Laboratory practice (a compilation) Fac. Of Vet. Med. Univ of Nigeria, Nsukka*
- Etches, R. J. (1996). Reproduction in poultry. CAB International, Wallingford, UK Pp 241 – 250.
- Kammerer, D.M.; Moreng, R.E.; Muller, H.D and Hobbs, H. W. (1972). Turkey semen evaluation for fertility prediction. *Poultry Sci.* 51: 77.
- Marini, P. J and Goodman, B. L. (1969). Semen characteristics as influenced by selection for divergent growth rate in chickens. *Poultry Sci.* 48:859-865.
- Nodu, M. B; Berepubo, N. A. and Ovuru, S. S. (2005). Puberty onset in young female rabbits experimentally fed crude oil contaminated forage. Proceeding of the 30th Annual Conf. Nig Society for Anim Prod; Nsukka, March 2005. Pp 30 – 32.

Omeje S. I and Marire, B. N. (1990). Evaluation of the semen characteristics of adult cocks of different genetic backgrounds. *Theriogenology*, 34:1111-1118.

Ovuru, S. S.; Beropubo, N.. and Nodu, M. B. (2004). Biochemical blood parameters in semi-adult rabbits experimentally fed crude oil contaminated diets. *African J. Biotech* 3:343-345.

Ovuru, S.S. and Oruwari, B. M. (2005). The effects of weathered crude oil (Bonny light) on blood cell profile and organ weights in rabbits. Proceeding of the 30th Annual Conf. Nig Society for Anim. Prod; Nsukka, March. Pp 52-55.

Shore, R. F and Douben, P. E. (1994). Predicting ecotoxicological impacts of environmental contaminations on terrestrial small mammals. *Review environment Contam. Toxicology* 13:49-89.

Steel, R. G. D and Torrie, J. H. (1980). Principles and procedures of statistics. McGraw-Hill Co., New York.

Wekhe, S. N. and Okere, E. (2006). Histological effects of ingestion of crude oil polluted water in some organs of cockerels. Proc. 11th Ann. Conf. Anim Sci of Nig. Ibadan, September, 2006 Pp 1 – 2.

(Received 14th May 2007; Accepted 21st Jan. 2008)