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ANSInet
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan
Mob: +92 300 3008585, Fax: +92 41 8815544
E-mail: editorijps@gmail.com

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Effect of Crude Oil Polluted Water on the Haematology of Cockerel Reared under Intensive System

P.O. Akporhuarho
Department of Animal Science, Delta State University, Asaba Campus, Asaba, Nigeria

Abstract: This study was designed to investigate the effect of polluted water on the Hematological indices of cockerels fed with polluted water at 5 ml, 10 ml and 15 ml of crude oil. The results showed that there was a significant difference ($p<0.05$) in the Red Blood Cell (RBC) and White Blood Cell (WBC). Also, there was a significant difference ($p<0.05$) in the Mean Corpuscular Hemoglobin (MCH) and Mean Corpuscular Volume (MCV). There was no significant difference ($p<0.05$) in the Packed Cell Volume (PCV), Plasma Protein (P.P), Hemoglobin Concentration of Blood (HBC) and Mean Corpuscular Hemoglobin Count (MCHC). The significant reduction in RBC and WBC indicate hemolytic anaemia and exposes the birds to high risk of infections. This is due to injurious effect of the toxic components of the crude oil.

Key words: Effect, crude oil, polluted, haematology, cockerel

INTRODUCTION

Crude oil exploration is the main stay of the Nigerian economy and constitutes about 90% foreign exchange earning of the nation. Apart from the financial benefits, the rapid growth of the crude oil exploration and exploitation in South, South Nigeria, the inevitable and increasing frequency of environmental pollution have imposed untold hardships on the people in the oil producing community of the country. The spillages affect the waters and the land while gas flaring pollutes the atmosphere. The consequent economic losses are inestimable (Shore and Douben, 1994).

Crude petroleum is taken orally in many oil producing communities for the 'laxative effect' or a general antidote 'against poisonous substances' and witchcraft (Orisakwe *et al*., 2004; Udoele, 1997). This deserves attention owing to the possibility of bioaccumulation and bioconcentration of crude oil components in poultry, represent a pathway for delivery of potential toxicant to the human system (Imevbore, 1980; Ekekwe, 1981). The animals most at risk are those that come in contact with contaminated water surface. These include aquatic mammals and reptiles, birds that feed by diving or form flocks, as well as aquatic lives on shores lines (Suckanek, 1993).

Beyond the normal environment and ecological shocks of normal oil activities, oil operations have had pathological effects, especially on the oil province of Nigeria, the Niger Delta. The cells of many species including man are continually exposed to industrial pollutants and other compound (Whitelock and Gelboin, 1979). Therefore, haematological studies are of ecological and physiological interest such as helping to understand the relationship of blood characteristics to the environment (Ovuru and Ekweozor, 2004).

Harmful effects on animals and fish exposed to pollution have been reported by many researchers including White (1975), Peterson *et al*. (1983), Nwokolo, *et al*. (1984), Monsi *et al*. (1991) and Borepubo *et al*. (1994). Butler (1988) had earlier reported reduced laying and lowered growth rates while Brain-Dicks (1998) reported reproductive failure. Hence this studies is to investigate the effect of crude oil polluted water on the haematological parameters of cockerel.

MATERIALS AND METHODS

Sixty day-old cockerels purchased from a reputable hatchery in Agbor were used for this study in the Delta State University, Asaba Campus Teaching and Research Farm. On arrival in the farm, they were left to rest for one week to recover from transportation stress and to acclimatize to the environment. They were randomly distributed into four groups (A, B, C and D) of 15 birds per group. Group A served as the control while birds in groups B, C and D were placed on crude oil contaminated water levels of 5ml, 10ml and 15ml respectively (i.e. 0.05%, 0.10% and 0.15%). The water was contaminated using syringe with a maximum calibration of 20 ml. All the groups were replicated thrice with five birds each. Feed and water were served *ad libitum*. Administration of contaminated water was began on the eight day. The crude oil used for this study was obtained from Warri Refinery and Petrochemical Company, Warri under the permission from the Department of Petroleum Resources, NNPC, Warri, Nigeria. The crude oil was stored in a clean container and kept in laboratory until its required for used. Blood samples were aspirated with 5 ml disposable syringes by cardiac puncture from all the groups. The blood sample collected into anti-coagulated bottle containing EDTA, was immediately taken to the University Laboratory for the determination of haematological parameters i.e. Packed Cell Volume (P.C.V), Plasma Protein (PP) and haemoglobin blood concentration.

Total Red Blood Cells (RBC) and White Blood Cell (WBC) counts were estimated. Other haematological parameters such as Mean Corpuscular Haemoglobin (MCH) and Mean Corpuscular Volume Haemoglobin Count (MCHC) were computed using the following formulas:

$$MCHC\ (\%) = \frac{Haemoglobin\ (Hb)}{PCV} \times 100$$

$$MCH\ (pg) = \frac{Hb \times 10}{Total\ red\ cells}$$

$$MCV\ (Fc) = \frac{Packed\ Cell\ Volume\ (PCV)}{Total\ red\ blood\ cell}$$

RESULTS

The Table 1 shows the haematological indices of birds following the ingestion of crude oil contaminated water for four (4) weeks. There was no significant difference ($p<0.05$) for the PCV in all the treatment group.

For Plasma Protein (P.P), the B, C and D have mean value of (7.00±1.00), (7.00±0.00) and (8.50±0.50) when compared with A with mean value of (7.50±0.50). This means there was no significant difference ($p<0.05$). For HBC, there was a corresponding mean value for A, C and D with a little variation in B, with the following mean value; A (77.50±20.00), C (73.75±11.25), D (73.75±1.25) and B (57.50±5.00), there was no significant difference ($p<0.05$).

For MCHC, A had similar mean value with B, C and D with the values as follows; A (2.18±0.01), B (1.98±0.02), C (2.20±0.01) and D (2.11±0.01) respectively. There was no significant difference ($p<0.05$).

There was a reduction in the RBC counts in C and D with 1.82±7.00 counts/mm^3 of blood in (N x 10^{13}) in C and 1.52±4.50 counts/mm^3 of blood in (N x 10^{13}) in D. The decrease was significant with A and B having 2.83±5.00 counts/mm^3 of blood in (N x 10^{13}) in A and 2.42±0.17 counts/mm^3 of blood in (N x 10^{13}) in B. This means there was a significant difference ($p<0.05$) in the RBC.

In WBC, there was a reduction in B, C and D with mean counts/mm^3 of blood in (N x 10^{13}) for 2.03±0.14, 1.40±7.00 and 1.23±4.00 when compared with A, having counts of 2.75±7.50. This reduction indicates a significant difference ($p<0.05$).

There was a significant different ($p<0.05$) in MCH with C and D having a mean value higher than A and B with values as follows; 4.03±0.13 and 4.82±0.12 for C and D and 2.74±0.12 and 2.38±0.12 for A and B.

Finally there was higher value for C and D for MCV when compared with A and B. This shows that there was a significant difference ($p<0.05$) with mean values as follows: 1.84±0.06 and 2.29±0.06 for C and D and 1.25±0.05 and 1.20±0.05 for A and B respectively.

DISCUSSION

One of the major problems of the inhabitants of the Niger Delta region of Nigeria is contamination of water by crude oil which has toxic effect on aquatic lives. This contamination may not necessarily lead to outright mortality but may have significant effects which can lead to psychological stress and my function in animals (Omoregie, 1998).

The severity of the problems in the inhabitants of the area is dependent upon the point of contact with polluted water, hence, justifying the need for preparation of different crude oil concentration. From the present study, it is obvious that exposure of cockerels to crude oil causes a significant ($p<0.05$) reduction in RBC counts as concentration of crude oil increased. This would imply reduction in the level of oxygen that would be carried to the tissue as well as the level of carbon dioxide returned to the lungs. The values obtained for MCH and MCHC serve to indicate variation in erythrocyte shape and size, which is an indicator of anemia, was also reported in previous studies (Eastham and Slade, 1993).

The major functions of WBC are to fight infections, defend the body by phagocytosis against invasion by foreign organisms and to produce or at least transport and distribute antibodies in immune response. A significant reduction ($p<0.05$) in WBC count with increase in crude oil concentration, suggests that cockerels are exposed to high risk of infection, the observation in this study is similar to the findings of previous studies in which there was a reduction in total WBC count in goats as the level of crude oil

Table 1: Haematological indices of cockerel bird treated with polluted crude oil water

Parameter	A	B	C	D
PCV (%)	35.50^a±0.05	29.00^a±4.00	35.50^a±0.50	35.00^a±4.00
Plasma P.	7.50^a±0.50	7.00^a±1.00	7.00^a±0.00	8.50^a±0.50
RBC (10^{13})	2.83^b±5.00	2.42^b±0.17	1.82^a±7.00	1.52^a±4.50
WBC (10^{13})	2.75^b±7.50	2.03^b±0.14	1.40^a±7.00	1.23^a±4.00
HBC	77.50^a±20.00	57.50^a±5.00	73.75^a±11.25	73.75^a±1.25
MCHC (%)	2.18^a±0.01	1.98^a±0.02	2.20^a±0.01	2.11^a±0.01
MCH (Pg)	2.74^b±0.12	2.38^b±0.12	4.03^a±0.13	4.82^a±0.12
MCV (Fl)	1.25^a±0.05	1.20^a±0.05	1.84^b±0.06	2.29^b±0.06

A, B, C and D denotes the various treatments. ^{a,b}Means with similar superscript within a row are not statistically significant ($p<0.05$)

concentration increased (Ngodigha *et al*., 1999). It was argued that the reduction in WBC count in goat may be as a result of stress imposed by crude oil hydrocarbons. From these observations it is evident that ingestion of crude oil results in toxicity targeted at the haematological system and which will eventually affect every organ in the body.

Conclusion: The results generated from this study are suggestive of the fact that crude oil is an environmental stressor which causes depression of RBC and WBC counts in cockerels. Thus, it can be concluded that crude oil has serious consequences on haematological parameters in birds. Crude oil causes haemolytic anaemia which is attributed to the toxic effect of various components of the oil.

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