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Performance and Blood Indices of Finisher Broilers Given Graded Level of Crude Oil Contaminated Water

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Abstract
The effect of crude oil on some haematological, serum biochemical evaluation and performance of broiler chickens were carried out in this present study. The experiment was carried out in one of the poultry houses in the Teaching and Research Farm of the Delta State University, Asaba Campus. A total of one hundred and forty eight day-old broiler chicks (marschall strains) were purchased from a reputable hatchery in Ibadan, Oyo State. and used for the study. At the end of the brooding period, the birds were rearranged into four treatment groups of 40 birds each with five replicates and they were subjected to crude oil contaminated water at the level of 0.0ml, 5.5ml, 10.5ml, and 15.5ml. From the results, there was no significant (P>0.05) difference between treatment groups in weight and weight gain although the mean value continue to decrease as the concentration of crude oil increases. However, there was significant (P < 0.05) difference between feed and water conversion ratio as the level of crude oil contamination increases. Haematological parameters such as packed cell volume (PCV), plasma protein (PP) and mean corpuscular hemoglobin concentration (MCHC) show significant (P < 0.05) difference while there were no significant (P > 0.05) in white blood cell count (WBC) and Red blood cell count (RBC) but the values continue to decrease as the crude oil increases. Serum characteristics show significant (P < 0.05) difference in cholesterol and albumin while there was no significant (P > 0.05) difference in total protein and urea, and the mean values continue to increase as the concentration of the crude oil increases. In conclusion, the results indicate that crude oil is an environmental stressor which had effect on blood cell profile, serum indices and the general performance of the birds.
Keywords: Broiler, Birds, Crude Oil, Performance, Blood Indices

Introduction

Since the discovery of crude oil at Olobiri in the Niger Delta Area of Nigeria in 1956, Nigeria has had its own share of the negative environmental consequences resulting from crude oil exploration, storage, processing and distribution. The growth of country oil industry, combined with a population explosion and lack of enforcement of environmental regulation have led to substantial environmental damage especially in the Niger Delta region (Achuba 2005). This is because for operational, accidental and other reasons crude oil has been frequently released into the Niger Delta environment over the years, leading to the pollution of the aquatic and terrestrial ecosystems.

The devastating consequences of crude oil spill with the eventual hazards on both aerial and terrestrial environment manifest as an irreversible chain effect on both biodiversity and human safety (George and Sese (2012). As this occurs, the oil threatens surface water and a wide range of subsurface marine organisms which are linked in a complex food chain (Katwijk Vam *et al.,* 1999). Aquatic environments are made up of complex inter-relationship between plant and animal species and any adverse alteration of their physical environment will often lead to death of one or more species in a food chain, which may also lead to damage for other species further up the chain. Whether an organism spends most of its time in open water, near coastal areas or on the shoreline will determine the effects oil spill is likely to have on the organism (Gardner *et al.,* 1991). As stated earlier, its deleterious effect on animal lives know no bound as it affects all aspects of animal development including growth and reproduction (Akpohuarho (2011).

However, poultry production is of great importance to man due to its contribution to the provision of protein throughout the world through such products as meat and egg which have high nutritive value to man. Poultry dropping are used as sources of manure and poultry production provide employment opportunity (Rodenburg *et al.,* 2003). Consequently, for there to be optimum production of meat, egg and maximum growth of birds, they have to be given the proper nutrition. All poultry species must receive sufficient clean water daily to balance losses and provide optimum amount needed for new tissue formulation and other production. Sources of drinking water for poultry production are very important particularly with intensive system. The exploration of crude oil brings about the pollution of our environment including our water ways. Hence crude oil exposure presents a potential hazard to both aquatic and terrestrial species (Shore and Douben, 1994) many genetic researches are now directed towards investigating the relationship between physiological, biochemical and metabolic products/markers and the productive efficiency of farm animal, haematological traits are studies with a view to explain the physiological basis of performance trait which could help to identify a selection criterion that can be useful in animal improvement.

The genetic makeup of an individual always interacts with the environment. Individuals found to be

superior in one environment may not be able to maintain their superiority in another environment. This causes variation in the performance of individual in a different environment (Marthur and Horst 1994).

In the humid tropical, there is dearth information on immunological parameters of exotic and native chickens, especially those with tropically relevant genes. This limits objective database which could be tapped from these studies, in order to design appropriate breeding strategies. Consequently, this study was designated to investigate and evaluate the effect of crude oil contaminated water for broiler chickens on (1) Performance (2) some haematological and Serum components.

Materials and Methods

Experimental Location

The experiment was conducted in the Poultry Unit of the Teaching and Research Farm of Delta State University, Asaba Campus, Delta State, Nigeria. Asaba is located between 60^0 45^1 East and 60^0 12^1 North of the equator. Annual rainfall in Asaba ranges from 1800-3000mm while maximum day temperature ranges from 27.5^0c - 30.9^0c (Federal Ministry of Aviation; Department of Meterological Services Asaba, 2013).

Poultry House Preparation

The house was partitioned in line with the design of the experiment. The house was properly washed and cleaned with disinfectant. The floor was uniformly covered with litter materials (wood shavings) to absorb watery droppings, oil stoves and hovers were provided for adequate heat conservation.

Collection of Crude Oil

The crude oil used was obtained from Warri Refinery And Petrochemical Company under the supervision of the Department Of Petroleum Resources, NNPC, Warri, Nigeria. The crude oil was stored in a clean container and kept in our laboratory until it is required for use.

Management of Experimental Birds

A total of one hundred and forty eight days old broilers chicks were used for this experiment. The birds were fed ad libitum and vaccinated routinely against coccidiosis, new castle, fowl pox, and gumboro diseases. The birds were randomly distributed into four treatment groups and replicated five times. Treatment 1 served as the control which received clean water while Treatment$_S$ 2,3 and 4 were the group that received water polluted with 5.5ml, 10.5ml, and 15.5ml of crude oil. The water was contaminated with the aid of a syringe with a maximum calibration of 20ml. At the end of the four weeks, five birds were randomly selected from each treatment group (one from each replicate) for blood sample. The birds were slaughtered and blood was collected through the jungular vein. Blood samples approximately 10 ml per bird were collected into specimen bottles with or without ethylene diamine tetra-acetic acid(EDTA) .Hematological parameters such as Packed Cell Volume(PCV), Plasma Protein, Haemoglobin Concentration of Blood(HB), Total Red Blood Cell Count(RBC), White Blood Cell Count (WBC) and Mean Corpuscular Haemoglobin Concentration were determined. Samples for biochemical analysis were collected into anti-coagulant free tubes and allowed to clot for two hours at room temperature and centrifuged for ten mints at 200 rpm to separate the serum. The parameters studied include the following: glucose, albumin, cholesterol and total protein.
The MCH and MCHC were calculated from the standard relationship of haematocrit and red cell count.

Feeds and feeding

The bird were fed ad libitum on starter marsh containing 20% crude protein and 2996 Kcal/kg metabolizable energy (ME) from Day old – 4 weeks of age. Then, grower marsh containing 15.86% crude protein and 2716 Kcal/kg ME was offered to the birds 4-6 weeks of age. Fisher marsh with 16.80% crude protein and 2823 Kcal/kg ME was provided from 6-8weeks of age.

TABLE 1 COMPOSITION OF THE EXPERIMENTAL DIETS'

Ingredient	Starter Diet	Growers Diet	Breeders Diet
Maize	45.95	55.45	56.95
Groundnut Cake	25.00	15.00	20.00
Wheat Offal	18.00	20.00	15.00
Fish Meal	3.00	1.50	2.00
Bone Meal	2.00	2.00	2.00
Limestone	5.00	5.00	5.00
Premix	0.25	0.25	0.25
Salt	0.30	0.30	0.30
Lysine	0.25	0.25	0.25
Methionine	0.25	0.25	0.25
Total	100.00	100.00	100.00
Calculated ep(%)	20.17	15.86	16.80
ME(Kcal/kg)	299640	2716.00	2823.14

Promix Contained:- vitamin A 1500i.u; VitD$_3$, 3000iu ; VitE12,iu;VitaminK2.4mg;thiamine3.0mg;Riboflavin,6.0mg;pyriooxine4.8mg; 1000mg;nicotinic acid 43mg;calcium panthotenic acid 12mg; 0.6mg; Vitamin B12 0.024mg;vitamin B2 5mg; folic acid 12mg; chlorine chloride, 350mg manganese, 56mg, lodin 1mg; zinc 50mg, copper, 400mg, lodine,20mg;cobalt, 1.25mg, selenium, 4.8mg

Statistical Analysis/Design

Haematological and Serum Analyses

The Packed Cell Volume (PCV), was established by spinning about 75.1 of each blood sample in heparinized capillary tubes in a haematocrit micro centrifuge for five minutes while the total Red Blood Cell count (RBC) White Blood Cell count (WBC) was determined using normal saline as the diluting fluid. The Haemoglobin Concentration (HBC) was established using cyanomethaemoglobin method. The total protein, albumin and Urea of sorum were determined as described (Lamb, 1981) cholestoral according to (Roschla et al, 1974).

The data obtained were subjected to analysis Of variance (ANOVA) and significant differences between treatment means were determined by Duncan Multiple Range Test (Duncan,1955).

The experimental design for this study was a completely randomized design (CRD).

Results

Table 2: The performance characteristics of broiler chickens subjected to graded level of crude oil in contaminated water.

Parameters	Treatments				
	Tr_1	Tr_2	Tr_3	Tr_4	SEM
Initial weight gain / bird (kg)1-4wks	44.48	43.45	43.51	43.09	0.30
Final weight gain / bird (kg) 5-8wks	96.49	94.45	93.75	93.09	0.74
Weight gain	52.00	51.00	50.24	49.99	0.80
Total feed conversion ratio 5-8wks	1.15^a	0.85^b	0.81^b	0.73^b	0.59
Total water conversion ratio 5-8wks	3.38^a	2.57^{ab}	1.95^b	1.73^b	0.22

a,b means within the same row are significantly (P<0.05) (P<0.00) different.

KEY: Tr_1 is the control which received clean water, Tr_2 received 5.5 mls of crude oil, Tr_3 received 10.5mlsof crude oil, and Tr_4 received 15.5mls of crude oil

Performance

The performance of the test birds fed graded levels of crude oil contaminated water is presented in table 2. Total feed and water conversion ratio showed a significant ($P < 0.05$) difference between treatments. Feed and water conversion ratio mean value decreased with increasing concentrations of crude oil in the water. Weight and initial weight gain showed no significant ($P > 0.05$) difference between treatment groups, although the mean value continue to decreased as the concentration of the tested ingredient increases.

Haematological Characteristics.

Haematological and Serum parameters are good indicators of the physiological status of animal and its changes are of value in assessing the response of animals to various physiological situations Khan and Zafar; (2005).

Data on the effects of crude oil contaminated water on some haematological characteristics in the experimental animals are presented in table 3. Significant ($P < 0.05$) PCV values were observed. The PCV

values were highest in treatment 1 the control (34.60 ± 1.63) and lowest in treatment 3 (20.20 ± 1.24) while treatment 4 is similar to treatment 1 which served as control. The data on plasma protein (Pp) were also presented in Table 3. A significant ($P < 0.05$) difference in Haemoglobin concentration of the blood values was observed, with treatment 1 having the highest value. Significant ($P < 0.05$) difference were similarly observed in the mean corpuscular haemoglobin concentration (MCHC) with the highest values in treatment 1 and lowest in treatment 3, although treatment 4 is similar in values with treatment 1 and 2. There was no significant ($P > 0.05$) difference in white blood cell count (WBC) and Red blood cell count (RBC) but mean values continue to decrease linearly as the crude oil concentration increased.

Table 3: Haematological Parameters of Broiler Chickens given Graded level of Focados Blend Crude oil in their Water

Parameters	Tr_1	Tr_2	Tr_3	Tr_4
PCV%	$34.60^{a} \pm 1.63$	$22.80^{bc} \pm 4.04$	$20.20^{c} \pm 1.24$	$29.40^{ab} \pm 2.68$
P.Protein	$6.40^{a} \pm 0.24$	$5.60^{b} \pm 0.24$	$5.00^{b} \pm 0.00$	$6.60^{a} \pm 0.24$
HBC	$61.00^{a} \pm 3.22$	$40.10^{b} \pm 6.80$	$16.50^{c} \pm 4.51$	$36.50^{b} \pm 3.76$
RBC(10^{-6})	$1.91^{a} \pm 0.25$	$1.19^{a} \pm 0.34$	$0.98^{a} \pm 0.24$	$0.27^{a} \pm 0.45$
WBC(10^{-6})	$3.60^{a} \pm 0.93$	$2.65^{a} \pm 0.17$	$1.95^{a} \pm 0.14$	$0.68^{a} \pm 0.48$
MCHC	$25.36^{a} \pm 1.87$	$23.68^{a} \pm 2.31$	$8.76^{b} \pm 1.68$	$18.51^{a} \pm 2.85$

a,b,c means with similar superscript within a row are different (P<0.05) significantly.
KEY: Tr1, Tr2, Tr3 and Tr4 denotes the various treatments.
Packed cell volume(PCV),Plasma protein(P.P), Haemoglobin concentration of blood(Hb),Red blood cell count(RBC), white blood cell count, Mean corpuscular haemoglobin concentration.

Serum Characteristics of Broiler Chickens

The results of the blood serum on the bird subjected to crude oil contaminated water at different level are presented in Table 4. Significant ($P < 0.05$) difference was observed in cholesterol and albumin. Treatment 3 and treatment 1 which served as control are similar in albumin. Treatment 2 had the highest value when compared with other treatment groups. There was no significant ($P < 0.05$) difference in the mean value of total protein and urea.

Table 4 shows the Mean of Serum Parameters of Broiler Chickens given Graded level of Focados Blend Crude Oil in their Water

	Treatments			
Parameters	Tr_1	Tr_2	Tr_3	Tr_4
Cholesterol	$0.18^{b} \pm 0.05$	$0.38^{a} \pm 0.07$	$0.19^{b} \pm 0.03$	$0.13^{b} \pm 0.02$
T.protein	$0.38^{a} \pm 0.04$	$0.70^{a} \pm 0.16$	$0.39^{a} \pm 0.06$	$0.47^{a} \pm 0.18$
Urea	$0.27^{a} \pm 0.18$	$0.28^{a} \pm 0.05$	$0.35^{a} \pm 0.15$	$0.39^{a} \pm 0.10$
Albumin	$0.12^{c} \pm 0.03$	$0.74^{a} \pm 0.09$	$0.29^{bc} \pm 0.06$	$0.34^{b} \pm 0.06$

a,b,c means with different superscript are different (P<0.05) significantly.
KEY: Tr_1, Tr_2, Tr_3, and Tr_4 denote the various treatments.

DISCUSSION

The effects of crude oil contaminated forage on the performance and haematological characteristics of animals have been reported by other researchers (Ebiegberi 2009). An environmental stressor such as crude oil has been found to change blood chemistry and cause antibody depression, alter white blood cell counts, including lymphatic involution among other effects, via the ACTH and glucocorticoids in stressed animals; (Siegel, 1980 and Sudakov, 1992).

The performances of the birds were adversely affected by the crude oil contaminated water. The higher

concentrations of crude oil inclusion in treatment 2, 3, and 4 significantly ($p < 0.05$) depressed feed conversion ratio. The reduced feed and water intake associated with crude oil ingestion adversely affect certain physiological activities in the body which resulted in the poor performance of the birds in treatment 2, 3, and 4. Ebiegber, (2009) observed similar detrimental effects on (W AD) goats when forage contaminated with crude oil was fed to them at different levels of between 1.5g/kg forage – 3.0g/kg forage. While lower concentration did not exert any such adverse effect on feed intake. Heywood (1981) reported that the suppression of body weight gains by toxic components is often or commonly associated with reduced feed intake. Crude oil ingestion in one form or another, during the critical development stages is known to depress growth performance (Rolling *et al* 2002).

Blood represents a means of assessing clinical and nutritional health status of animals in feeding trial and the haematological parameters mostly commonly used in nutritional studies include PCV, RBC, ABC, MCHC, MCV and clothing time (Aleton and Egberongbe; 1992, Olorede and Longe; 2000, Adeyemi *et al*, 2000). The results of haematological variables in this study suggest that the crude oil did precipitate severe effects on the health status of the experimental chicks.

The observed linear ($P < 0.05$) reduction of PCV values showed that they decreased with increasing levels of crude oil administration. The result suggested an anemic condition which was particularly observed in the birds in treatment 3. Any adverse effect of crude oil toxicity may be attributed to Naphthalene, Toluene and Benzene Rice; (1997).

Benzene has been found to induce anaemia due to bone marrow hypoplasia Hiraq, 1972, Saita, 1974. This phenomenon may be explained by the ingested crude oil which imposed a physiological stress on the birds and therefore caused the release of glucocorticoids which have been found to deplete erythrocytes (Siegel 1980), probably via involution of bone marrow (White, 1975), hence the observed reduction PCV in this study. The blood cell counts of the birds were all significantly altered with the increasing volume of the crude oil in their water. The observed linear reduction in haemoglobin count, demonstrate and also suggest an anemic condition in the crude oil treatment birds. This report is supported by Synder (1987) who demonstrated that benzene is activated in the bone marrow. These cytotoxic effects are mediated through disturbance in DNA function. Thus bone marrow failure as in this recent study is characterized by inadequate production of red cell and other formed elements.

The major function of white blood cells is to defend the body against foreign bodies which is achieved by leucocytosis and antibody production (Robbin and Angel, 1976). Total white blood cell count decreased with increasing concentration of crude oil. This observation is in consonance with the finding of Ngodigha *et al* (1999) in which there was a reduction in total white cell count in goats as the level of crude oil concentration increased.

Serum cortisol levels are known to increase in the hypothalamic – pituitary – adrenocortical system during a period of stress and may trigger a suite of behavioral and physiological responses including a rise in locomotion activity and adequate mobilization of energy store, Wingfield *el al*, 1997 and 1998. This findings support the observation in this present study in which urea and albumin was observed to be increasing with the increasing of crude oil concentration in the birds water.

Serum total protein levels is a rough measure of protein status but reflects major functional changes in kidney and liver functions Agrawal and Johri (1990). They have nutritive, transporting, protective, buffering and energy functions, (Sese *et al* 2003). In this present study, these parameters increase with increase concentration of crude oil in their water. A rise in plasma total protein and albumin could be an indication of haemoconcentration, presence of abnormal globulins or some form of liver and kidney dysfunction, Gamong, (2005).

Cholesterol is a key intermediate in the biosynthesis of related sterols such as bile acids, adrenocortical hormones, androgens and estrogens. Rahmani *et al* (1988) in this study increased cholesterol in treatment 2 and 3 with increasing concentration of the tested ingredient in thier water was observed. This increase in cholesterol may be an indication of renal retention disease resulting in diminished removal of lipoprotein from the plasma, thus causing the concentration of cholesterol to increase. This finding is supported by earlier studies in which cholesterol was measured in blood, which reported that palm oil, a saturated fatty acid was implicated in increased level of cholesterol in roosters and rabbits. Oruwari *et al* (1998). In conclusion, the administration of crude oil into the broilers drinking water in one form or the other had negative effect on the general well being of these animals.

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