

Haematological Responses Of Grower Pigs Fed Crude Oil-Contaminated Diets

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Abstract: The effects of graded levels of crude oil-contaminated diets were investigated on haematological parameters in growing pigs. 24 pigs of average body weight (BW) of 8 ± 1.1 (Mean \pm SD) kg were used in the trial. The animals on arrival at the Animal Wing, Rivers State University were randomly allotted to their experimental pens. There were 6 dietary treatments with varied levels of crude oil contaminations as: 0g (control group), 2g, 4g, 6g, 8g and 10g of crude oil/kg of diet, respectively. There were 4 replications per treatment. The animals were fed at 5% of their BW. Trial lasted for 4 weeks (28d); blood samples were collected from all animal treatment groups and immediately snap frozen. Red blood cell (RBC) counts, haemoglobin (Hb), packed cell volume (PCV) concentrations as well as white blood cell (WBC) counts, including their differentials: neutrophils (NEU), lymphocytes (LYM), eosinophil (EOS) and monocytes (MON) were analyzed. There were no significant ($P > 0.05$) differences in the RBC, Hb and PCV contents. Furthermore, there were no significant ($P > 0.05$) differences in the WBC counts as well as their differentials. It was concluded that growing pigs can ingest up to 10g of crude oil/kg of diet without any negative effects on blood constituents of the growing pig.

Key words: Blood Parameters, Crude Oil, Contamination and Pig.

1 Introduction

Blood parameters have been shown to be one of the major indices of physiological, pathological and nutritional status of an animal [8]. Changes in the constituent elements of blood are normally used to evaluate the metabolic state of the animal as well as the quality of feed [2]. [5] showed that haematology and serum chemical assay can be used to confirm the physiological disposition of the animal to their nutrition. [10] observed that benzene a constituent of crude oil induced leukemia, erythropenia, neutrophilia, lymphocytosis and alteration in platelet morphology. [9] reported decreased erythrocytes, platelets and PCV in rabbits that ingested crude oil. Furthermore, it has been shown that the incorporation of crude oil into broiler feeds and water decreased RBC counts and Hb concentration but increased WBC counts [1]. [7] also reported haematological changes in goats that ingested forages contaminated with crude oil. In that study, it was also reported that crude oil ingestion caused significant reductions in PCV, eosinophil, neutrophil, leucocytes and monocytes. They concluded that these blood parameters linearly reduced as the level of crude oil ingestion by the animals increased; suggesting that crude oil ingestion causes significant changes in blood chemistry. Hitherto, there is no study that has investigated the effect of crude oil on the haematological parameters in growing pigs in the literature. Thus to our knowledge the effects of ingestion of crude oil on blood characteristics have been studied in different animal species except in the pig. Therefore, the objectives of this study are to assess the effect of ingestion of graded levels of crude oil-contaminated diets on the haematological parameters of the growing pig, such as RBC counts, Hb and PCV concentrations, WBC counts and its differentials in the growing pig.

2 Materials and Methods

Experimental Animals and Management

Twenty four growing pigs of average initial BW of 8 ± 1.1 (mean \pm SD) kg were bought from Cape Farms, Irete, Imo State, Nigeria and humanely transported to the venue of study. The animals on arrival at the Animal Wing, Rivers State University Teaching and Research Farm were randomly assigned to their individual experimental pens. Before their arrival the animals' pens were thoroughly washed and disinfected with detergents and allowed to dry properly. The animals were given 14-days to acclimatize to their new environment. At this time the animals were given ivermectin injection sub-cutaneously and amoxicillin antibiotic injection intramuscularly to ensure good health status before commencement of study and fed similar grower diet. At the end of the adaptation period, the animals were offered their crude oil-contaminated diets at 5% of their BW twice daily according to the method of [6] at 09:00h (half of the daily meal) and 16:00h, respectively. As expected, water was provided ad libitum via low pressure nipples and pens were constantly kept cleaned throughout the experimental duration.

Crude Oil and Experimental Diets

The crude oil used in this study is specifically Bonny Light obtained from the Nigerian Agip Oil Company limited. Before the commencement of study the crude oil was exposed to sunlight for 24 h in a shallow pan to enable the escape of the light volatile fractions via evaporation thereby ensuring a stable product that simulates crude oil natural form during oil spillage and pollution [9]. Six corn-soybean meal-based diets that were isocaloric and isonitrogenous to

meet or exceed the [8] recommended nutrient requirements of growing pigs of 10 – 20 kg BW were used in the study. Although the diets had similar nutrient levels they differed in their dietary crude oil contents as: diet1, the control diet (0g crude oil), diet 2, (2g crude oil), diet 3, (4g crude oil), diet 4, (6g crude oil), diet 5, (8g crude oil) and diet 6, (10g crude oil)/kg of diet, respectively. Animals received their respective experimental diets for 4 weeks (28d).

Data Collections and Analyses

At the end of the study period, blood samples were collected from all animals into EDTA treated tubes and were immediately snap frozen for later blood parameters analyses. Blood were analyzed by hematology auto-analyzer machine (BC-2300). The experimental data were analyzed as a CRD. Data were subjected to analysis of variance (ANOVA) using PROC GLM of SAS (SAS Inst. Inc., Cary, NC) according to the experimental model: $Y_{ij} = \mu + D_i + E_{ij}$; where Y_{ij} is the observation, μ = overall mean common to all treatments, D_i = the effect of the i^{th} diet and E_{ij} = the error term. Means were compared using Tukey's test and α -level of 0.05 was used for all statistical comparisons to represent significance.

3 Results and Discussion

The results of the RBC, Hb and PCV values are shown in Table 1 whereas the results of the WBC counts and its differential are shown in Table 2, respectively.

Table 1. RBC, Hb and PCV concentrations of Pigs fed varied crude oil-contaminated diets

Item	DIET						SEM	P-value
	Diet 1 n = 4	Diet 2 n = 4	Diet 3 n = 4	Diet 4 n = 4	Diet 5 n = 4	Diet 6 n = 4		
RBC ($\times 10^9/l$)	5.00	4.77	5.00	5.00	5.00	4.55	0.228	0.989
Hb (g/dl)	13.00	12.75	12.75	12.75	12.75	12.75	0.289	0.189
PCV (%)	31.00	30.76	30.88	31.10	31.20	30.95	0.258	0.796

Table 2: WBC counts and its differentials fed varied levels of crude oil-contaminated diets.

Item	DIET						SEM	P-value
	Diet 1 n = 4	Diet 2 n = 4	Diet 3 n = 4	Diet 4 n = 4	Diet 5 n = 4	Diet 6 n = 4		
WBC ($\times 10^9/l$)	5.75	5.75	5.50	5.75	5.75	5.60	0.263	0.983
NEU (%)	61.25	59.75	57.30	57.25	58.50	59.00	1.934	0.959
LYM (%)	37.75	39.75	42.75	41.75	40.25	40.25	1.387	0.795
EOS (%)	0.50	0.25	0.75	1.00	0.50	0.50	0.534	0.575
MON (%)	0.50	0.25	0.50	0.00	0.75	0.25	0.377	0.931

As shown in the two Tables of results above, there were no significant ($P > 0.05$) differences in the RBC, Hb and PCV concentrations amongst animals in all dietary treatment groups. Similarly, there were no significant ($P > 0.05$) differences again amongst animals of all dietary treatment groups in WBC counts, and its differentials (NEU, LYM, EOS and MON), respectively. In animal studies, the changes observed in blood constituents of animals when compared to the normal values usually based on the control treatment from such studies are used to assess the influence of diets on the metabolic state and quality of the feed [2] – [3]. Furthermore, [4], and [5] showed that haematology assays always give better clues in understanding the physiological disposition of the animal to their diets. In this study, there were no significant differences in all the blood parameters determined, suggesting that the health of animals in all dietary treatment groups were intact meaning that the animals' health status of the animals in all experimental groups were not perturbed [5]. Additionally, the findings of no differences in all blood parameters measured also pointed to the direction that growing pigs can tolerate crude oil up to 10g/kg of diet with no alterations to blood morphology and chemistry [2]. However, further studies with similar crude oil levels of contaminations would be tested on liver and kidney biomarkers as well as on antioxidants and oxidant statuses of growing pigs to be able to draw a solid conclusion on growing pigs and crude oil tolerance level in their diets.

4 Conclusion

Growing pigs can ingest up to 10g of crude oil/kg of diet without any alterations in their blood morphologies and composition. This level of crude oil ingestion therefore, does not jeopardize or compromise their blood health status. However, these findings would be further be evaluated using other pig parameters.

5 References

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