

Growth And Electrolytes Responses Of Grower Pigs Fed Crude Oil-Contaminated Diets

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Abstract: This study was conducted to examine the effects of the ingestion of graded levels of crude oil-contaminated feeds on the growth performance and electrolytes parameters in the growing pig. 24 landrace growing pigs weighing on average 8 ± 1.1 (mean \pm SD) kg of body weight (BW) were randomly assigned to six dietary treatment groups of 4 pigs per treatment. Dietary groups were: 0g, 2g, 4g, 6g, 8g and 10g of crude oil/kg of diet. Animals were fed at 5% of their BW. The experiment lasted for four weeks. At the end of study all pigs were weighed to obtain their final BW. Average daily feed intake (ADFI), average daily gain (ADG) and feed efficiency (FE) were evaluated. Blood samples were also collected from all animals in the treatment groups into tubes and snap frozen for electrolytes analyses: sodium (Na^+), potassium (K^+) and chloride (Cl^-). There were no significant ($P > 0.05$) differences in all parameters measured. It was concluded that the levels of crude oil contaminations used in the study were below the threshold for growing pigs.

Key words: Growth parameters, Electrolytes, Crude Oil-Contaminations and Pig.

1 Introduction

The Niger Delta Region is the major crude oil exploration area in Nigeria. Therefore, the region for years had been exposed to crude oil contamination leading to environmental pollution and degradation. To this end, different independent studies have demonstrated that crude oil ingestion has various toxicological effects on animals that ingested crude oil-contaminated diets. Some of these effects are usually observed in the areas of feed intake, weight gain and feed efficiency [2]. [11] found that ingestion of crude oil-contaminated feed adversely affected growth performance in poultry. [2] found that fumes from crude oil also led to retardation of growth in poultry. [7] observed a significant decline in feed intake and severe depression of growth in birds fed crude oil-contaminated feed. In that study, it was also shown that the degree of severity in feed intake and growth rate increased as the level of crude oil increased in the diets. [5] also showed reduction in feed intake, severe depression in growth rates and organ atrophies amongst rabbits fed crude oil-contaminated feed. Similar data were also demonstrated in goats in the study of [9]. Also, in goats [8] demonstrated that feed intake, body weight gain and feed efficiency were adversely affected by the consumption of crude oil contaminated forages. It can thus be speculated that by these negative effects of crude oil ingestion on animal growth parameters, electrolytes metabolisms, such as those of sodium (Na^+) potassium (K^+) and chloride (Cl^-) of the animal might also be distorted. These speculations readily come to the fore as similar data are not available on pigs. Therefore, the objectives of this study are to investigate the effect of the ingestion of graded levels of crude oil-contaminated feeds on the growth performance and some electrolytes in the growing pig.

2 Materials And Methods

Animals and their Management

Twenty four (24) landrace weaner pigs of 10 – 12 weeks of age with an average initial BW of 8 ± 1.1 (mean \pm SD) kg were acquired from a reputable commercial hog farm

and used for the investigation. The animals on arrival at the Animal Wing, Rivers State University Teaching and Research Farm were weighed to obtain their initial BW and randomly assigned to their individual experimental pens. Prior to the arrival of the animals their pens were thoroughly washed and disinfected and allowed to dry properly before the arrival of the pigs. Before the commencement of the experiment proper the animals were allowed 14 days to fully acclimatize to their new environment. During this period the animals were given ivermectin injection sub-cutaneously and amoxicycline antibiotic injection intramuscularly to further help them stabilize for the study. During this period also, they were fed similar grower diets. At the end of the acclimatization period, the animals were offered their experimental diets at 5% of their BW (as-fed basis) twice daily at 09:00h (half of the daily meal) and 16:00h, respectively. Water was provided ad libitum and pens were constantly washed and cleaned throughout the experimental duration for the comfort of the animals.

Crude Oil Management, Experimental Diets and their Contamination Levels

The crude oil type used in this study was the Bonny Light obtained from the Nigerian Agip Oil Company limited. Prior to using the crude oil in contaminating the diets, the crude oil was exposed to sunlight for 24 h in a shallow pan to enable the evaporation of the light volatile fractions to ensure a stable product that mimics its natural form during pollution according to the method of [14]. This procedure simulates the condition that occurs naturally after an oil spillage [14]. Six corn-soybean meal-based diets formulated to be isocaloric and isonitrogenous to meet or exceed the [10] 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: diet 1, 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, all animals were re-weighed to obtain their final BW used in the computation of the average daily feed intake (ADFI), average daily gain (ADG) and feed efficiency (FE). Blood was also collected from all pigs for electrolytes analyses. Electrolytes were analyzed for according to the method of [4]. 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 growth performance parameters studied in this trial are shown in Table 1 and Table 2 shows the results of ingested crude oil-contaminated diets on serum electrolytes, respectively. All animals in the different treatment groups consumed their respective diets and grew throughout the experimental period without any obvious sign of feed rejection and without orts. This is an indication that the levels of crude oil used in this study were tolerable by pigs and probably below the threshold for growing pigs. This fact was further supported by the observation that there were no significant ($P > 0.05$) differences in all the growth parameters (ADFI, ADG and FE) assessed in this study (Table 1). This was also confirmed by the finding that there were no significant ($P > 0.05$) differences in the levels of the three electrolytes studied (Table 2).

Table 1: Performance of growing pigs fed varied levels of crude oil-contaminated diets.

Item	DIETS			
	Diet 1 n = 4	Diet 2 n = 4	Diet 3 n = 4	Diet 4 n = 4
ADFI (kg/d)	1.02	1.02	1.02	1.02
ADG (g/d)	452.25	452.50	456.50	455.00
FE	0.44	0.45	0.45	0.45

Table 2: Na^+ , P^+ and Cl^- serum levels of pigs fed varied levels of crude oil-contaminated diets.

Item	DIE TS						SE M	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		
Na^+ (mmol/l)	137.0	136.8	138.1	138.4	137.7	137.6	0.02	1.0
K^+ (mmol/l)	3.9	4.2	4.1	4.4	4.3	4.4	0.03	0.96
Cl^- (mmol/l)	101.5	102.0	102.3	101.7	102.2	101.6	0.02	1.22

A sound knowledge of how much or concentration of a toxic material, such as crude oil in the feed that would

affect animal performance and by implication has deleterious effects on the overall health of the animal are of interest to the animal producer, especially in the Niger Delta region of Nigeria where incessant crude oil pollution is very common [3 and 12]. This however, depends on the animal species, age and the animals’ physiological status [10]. The determination of such toxicant levels involves the addition of the toxicant in such a way that the material of interest is incorporated into the diets of the animal at different concentrations as done in this study with nutrients in the diet remaining constant [10]. The performance of the animal in particular and other parameters in response to the different levels of the toxicant intake are then measured. To this point therefore, the ADFI, ADG and FE are the first and easiest responses usually measured. Other parameters that can be measured include electrolytes, haematology, liver and kidney biomarkers and anti-oxidant as well as oxidant levels. In this study, it was found that there were no differences in the feed intake, growth rate as well as feed efficiency for all treatment groups. It has been shown that due to the toxic chemicals present in crude oil when ingested affect tissues and organs of the animals that ingested the crude oil and as a consequence led to reduced growth rate of such animals and eventually resulted in the animals’ poor performance [1; 6]. In this study, the performance of the animals in all the different levels of ingested crude oil-contaminated diets were not different meaning that performances were not compromised. This is an indication that the ingested crude oil had no effect on the animals. This can therefore be explained in part by the fact that the levels of crude oil ingested by the animals were below the threshold for growing pigs [1]. This assertion was further supported in this study by the fact that the crude oil ingested even up to 10 g/kg of diet also had no effect on serum electrolytes.

4 Conclusion

It was concluded that the levels of crude oil contamination used in the study were lower than the threshold for growing pigs. Growing pigs can ingest up to 10g of crude/kg of diet without feed rejection and any obvious deleterious effects on growth performance and electrolytes status. 0.45 0.003 0.978

5 References

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