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Survival and Reproductive Response of Adult Rabbits Exposed to Graded Levels of Crude Oil Contaminated Diets

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Abstract: A study was conducted to establish the survival and reproductive response of adults rabbits exposed to graded levels of crude oil contaminated diet. Thirty two rabbits of mixed breed of New Zealand White and Chinchilla were used in this study. The study entailed four treatment groups (designated) A, B, C and D with eight rabbits of equal sex ratio replicated four times were randomly assigned to each group. The levels of crude oil inclusion in the diet were 0.00%, (control A) 0.01, 0.02 and 0.03% for treated groups B, C and D respectively. The study lasted for fourteen weeks. There was no significant difference ($p>0.05$) in weight gain among the groups. The mean feed intake, average weekly body weight gain as well as final body weight were not significantly different ($p>0.05$) amongst the group. There was no mortality recorded at the highest inclusion rate of 0.03% in this study. Results obtained on the reproductive response revealed 68% were pregnant including the control group and 50% conception rate was recorded amongst the experimental groups. Therefore, it could be concluded that, the adult rabbits were able to survive, conceive and kindle at the highest crude oil inclusion rate of 0.03%, without any adverse effect on the experimental rabbits, hence establishing their survival level and reproductive capability of adults rabbits exposed to crude oil contamination.

Key words: Rabbit, crude oil, survival response, reproductivity and pollution

INTRODUCTION

There is considerable amount of data on the environmental pollution by crude oil and their effects on crops, soil, marine life, wildlife and poultry (Amadi, 1992) such data on livestock are relatively few in available literature (Berepubo *et al.*, 1994). Despite the fact that farm species (sheep, goat, cattle, swine and rabbits) could be exposed to crude oil pollution through various equipment and natural pastures. Berepubo *et al.* (1994) observed negative effect crude oil on the breeding performance of female rabbits. Genetic and environmental factors have been identified to influence the growth performance of livestock species (Preston and Willis, 1988). Oil spills are becoming unavoidable, especially in the Niger Delta Region of Nigeria where oil exploration and exploitation are taking place, resulting in contamination of the natural resources thereby the terrestrial and aquatic biota within the affected area suffers various degrees of devastation (Ovuru and Nodu, 2005). However, scanty works available on terrestrial animals and livestock indicate negative consequences of crude oil ingested on most parameters ascertained them (Berebupo *et al.*, 1994; Ovuru, 2002; Nodu, 2005). There is need therefore to establish the survival and reproductive response of animals especially rabbits exposed to crude oil pollution. It goes without saying that, the animals are at the risk of exposure to crude oil polluted farmlands, feed, crops, water and natural pasture. Among these livestock, rabbit stands out prominently as one of the species that is presently attracting attention due to its relatively small size, low investment or costs, quick and high returns. Rabbits, being herbivorous (pseudo-ruminant), having the quality to utilize forage, crop farm wastes and other agricultural by-products stands the risk of exposure to farmlands or pasture polluted by crude oil spills.

This study was therefore carried out to simulate oil spillage condition and establish the survival and reproductive response of adult rabbits exposed to the crude oil contaminated diets in Rivers State of Delta Region of Nigeria.

MATERIALS AND METHODS

Thirty two adult rabbits of equal sex ratio comprised of mixed breed of New Zealand white and Chinchilla were used in this study. They were randomly assigned into four treatments groups A, B, C and D comprising of eight rabbits of equal sex ratio per group in a randomized completely block design with each group replicated four times and each replicate consist of two rabbits of the same sex. The used of (RCBD) was based on the fact that the experimental adult rabbits were heterogeneous

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in age, sex, weight and breed. Group A served as control group fed mash feed free of crude oil contamination, while the other three groups were fed diet contaminated with crude oil at varying inclusion levels of 0.1 g/kg (0.01%), 0.2 g/kg (0.02%) and 0.3 g/kg (0.03%) of feed representing for B, C and D groups respectively. Two hundred grams of concentrate feed (growers mash) as recommended by Ibeawuchi and Fajuyitan (1986) was used in this study. Two hundred grams of the feed were provided per rabbit per day and all other husbandry managements adhered to accordingly. One ml graded pipette was used in measuring various levels of the crude oil, (0.01 mL reading in the pipette is equal to 0.1 g of crude oil). Inclusion of measured amounts of crude oil into the mash was by first mixing a little quantity of feed with crude oil followed by mixing thoroughly with the entire measured quantity. By this method, the feed was properly homogenized with the crude oil. Measured quantity of fresh forage was fed to the experimental rabbits as supplement, after substantial consumption of the treated feed. Water was served ad-libitum. Left over feeds weighed every evening to determine the actual daily feed intake.

The grade of crude oil used for this study was “Bonny Light”. Prior to use of the crude oil in contaminating the feed, the crude oil was exposed for 24 h in an open-shallow tray to evaporate. This process taken after White (1975) was carried out to ensure the stability of the product in the feed.

The study was carried out in the research and teaching farm of the Rivers State University of Science and Technology, Port Harcourt. The study lasted for three months. Initial weights of the rabbits were taken at the beginning of experiment, thereafter, weekly weights of individual rabbit computed at the end of every week early in the morning before they were served the experimental diets. Total weights of all the experimental rabbits were taken at the final day of the data collection. Daily feed intake was recorded in the evening (6 p.m.) by subtracting the weight of the left-over feed from (some of the feed are scattered under the rabbits in their drainage) the initial 200g feed supplied in the morning. Feed efficiency of individual rabbit was determined or evaluated at the end of the experiment using the formula; feed intake (g)/Weight gain (g) and further, the mean monthly feed conversion was computed.

At the expiration of the experiment, the data collected were analyzed using analysis of variance and Duncan Multiple Range Test by SAS (1999) employed to separate means where differences existed.

After two weeks of ingestion of dietary crude oil, the does in each group were introduced to the bucks of that group for mating and thirty-two days later, the exercise was repeated following the same technique, but involving the does that previously rejected the bucks.

RESULTS AND DISCUSSION

The mean initial and final weights of the experimental rabbits were tabulated in Table 1, also the weight gain, daily and total feed consumption, feed conversion and efficiency. There were significant differences ($p<0.05$) in the mean values of weight gain with control group recording the highest, followed by treated groups B and C with the mean values that were statistically the same while treated group D recorded the least. Significance difference ($p<0.05$) was observed in the daily feed intake with treated groups C and D recording the higher mean values than treated group B and A. The results on the feed conversion revealed significant effect ($p<0.05$) with control group A recording the higher mean values than the treated groups which were statistically similar.

The results obtained on reproductive response are presented in Table 2. It indicated that, out of the experimental does serviced by the bucks only eight conveniently accepted the bucks at the first mating (3 from control group A, 2 from group B, 2 from group C and 1 from group D). Thereafter, three does were successfully serviced by the bucks in the second mating trial; one in each of the treated groups B, C and D. kindling results for the two mating trials showed that two does kindled in the control group A and also two in treated group B, while group C and D kindled one each in the two mating exercise. 68% conception rate and 54.55% kindling was recorded among the groups including the control group A. While the treated group recorded 50% rate in both conception and kindling. The ability of treated does to be pregnant and to record high proportion of kindling showed that the does were able to survive and overcome the toxic effects of the crude oil.

Contrary to this finding, Berepubo *et al.* (1994) and Ngodigha *et al.* (1998) revealed that crude oil ingestion during critical developmental stages, depresses growth, impairs avoidance behavior and causes pathological changes in the kidney and atrophy of the reproductive organs. The moderate levels of crude oil contamination may probably explain why no significant body weight depression was observed in this study and the nutrient content of the concentrate growers mash used in this experiment provided better body immunity for the treated rabbits to combat the toxic effects of the crude oil ingestions which helps in the mating exercise and during their pregnancy and kindling. In variance with the results of this study, Nodu (2005) exposed pre-pubertal rabbits to crude oil contaminated forage at the highest inclusion rate of 20% and recorded severe depressed growth rate.

Similarly Ngodigha *et al.* (1998) exposed young West African Dwarf Goats to crude oil contaminated feed and observed depression in growth response and total rejection of the males by the females as the level of crude oil contamination in feed increased. In the same vein, Ovuru (2002) and Nodu (2005) observed negative consequences of crude oil ingested on most parameters studied in adults rabbits.

Table 1: Establishment of survival response level of adult Rabbits exposed to graded levels of crude oil contaminated diet (mean±S.E)

Experimental Groups	Initial weight (kg) mean±SEM	Final weight (kg) mean±SEM	Daily feed consumed (g)	Total feed consumed (kg)	Feed conversion	Feed efficiency	Weight gain (g) mean±SEM
A-0.0% Crude oil	1.50±0.10	1.82± 0.02[a]	80.02±0.02[b]	28.26±0.05[a]	43.61[a]	0.012±0.01[c]	530.00±0.05[a]
B-0.01% Crude oil	1.53±0.09	1.58±0.08[b]	86.10±0.03[b]	27.83±0.10[b]	32.86[b]	0.052±0.12[a]	490.00±0.04[b]
C-0.02% Crude oil	1.47±0.06	1.53±0.11[b]	92.06±0.12[a]	27.30±0.02[b]	30.40±0.02[b]	0.043±0.03[b]	470.00±0.02[b]
D-0.03% Crude oil	1.19±0.15	1.50±0.09[b]	97.06±0.7[a]	26.77±0.09[b]	28.72[b]	9.031±0.06[b]	440.00±0.04[c]

Different superscripts in column indicate significant difference between means at ($p<0.05$)

Table 2: Reproductive response of does Rabbits fed graded levels of crude oil contaminated diet

	Crude oil percent in the diet			
Diets	A	B	C	D
Pregnant and kindled of (%)	(0.0%)	(0.01%)	(0.02%)	0.3%
Pregnant in the 1st mating of (%)	37.50	25.00	12.50	12.50
Pregnant in the 2nd mating of (%)	0.00	33.33	33.33	33.33
Pregnant in the both mating of (%)	27.27	27.27	18.18	18.18
Kids Kindled in both mating of (%)	33.33	33.33	16.67	16.67

The survivability and recorded percentage of pregnancy of rabbits across the experimental period could be due to the low levels of crude oil inclusion rate coupled with quality of concentrate (growers mash) used in this study. A similar study conducted by Berepubo *et al.* (1994) with higher dosage levels of (0.05, 0.1 and 1.5%) resulted to excessive mortalities. They recorded 50% mortalities at the 0.05% crude oil inclusion whereby there was no mortality at 0.03% inclusion rate in the present study. Although 0.04% has not been tested, further research is necessary to test the effects at 0.04%, since rabbits exposed to 0.05% recorded 50% mortality.

Therefore, it could be said that 0.03% is presently the maximum crude oil ingestion level for rabbit survival and reproductive capability over a period of 14 weeks.

Conclusion: Therefore, it could be concluded that 0.03% is presently the maximum tolerated border of crude oil ingestion level for rabbit survival and reproductive capability over a period of fourteen weeks.

Recommendations: Although crude oil ingestion survival level has been established for rabbits, It is worthy to note that crude oil spillage has presently become the focus of increasing public concern because of the adverse effects its exert on livestock, environment and eventually humans. Since oil spills are for now inevitable in the Niger Delta Region of Nigeria, attempts therefore, should be made by the regulatory agencies of government concerned involved in petroleum resources to compel oil companies to focus attention on prevention of oil spillages. Where such spillages occurs, immediate attention should be given for proper clean-up exercise and compensation be made to affected victims.

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