



THE EFFECTS OF CRUDE OIL CONTAMINATED FORAGE ON BREEDING BEHAVIOR AND REPRODUCTIVE PERFORMANCE OF FEMALE RABBITS

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ABSTRACT: Oil spill is a major threat to the biodiversity and survival of land animals. In this study, the effect of oil contaminated forage on the breeding behavior and reproductive performance of female rabbits was tested in a completely randomized experimental design (CRD). Results show that oil contaminated forage result in decreased acceptance of males, no pregnancy and increased pseudo-pregnancy. Acceptability of males decreased as the level of crude oil increased in the contaminated forage. All the females (100%) in the control accepted males, 50% of the females in the 0.05% crude oil contaminated forage accepted males, 33.33% of them in the 0.1 % and 0.15% accepted males, while none of the rabbits in the 0.2% accepted males. It can therefore be concluded that oil spill can cause reproductive failure in rabbits, which could affect their sustainability.

Key words: oil spill, rabbit, burrowers

INTRODUCTION

In today's modern world, energy is very essential especially for powering homes, public building and other social infrastructures. The transportation sector is dependent on energy including the air, road, and water and rail transportation. Despite advances in alternative energy sources such as wind, solar, geothermal and biofuels, petroleum is the most important source of primary energy [18]. Crude oil is one of the most traded energy sources in the world. Notwithstanding the importance of crude oil, its exploitation has caused devastating environmental problems only second to nuclear disasters. Oil spill could occur during the exploration, production and transportation of crude oil. In the past, mechanical/equipment failures and corrosion were the major causes of oil spill in Nigeria, but recently, illegal bunkering, oil theft and artisanal refining of crude oil are the leading cause of crude oil spill [16, 17, 23]. The incidence, scale and severity of oil spills are increasing in Nigeria. for instance, Nwilo and Badeja [15] reported that between 1976 and 1996, a total of 4647 oil spill incidents occurred in Nigeria, resulting in the spillage of about 2.4 million barrels and from 1997 – 2001, the total number of spills incidents was 2,097. Vidal [24] cited by Ogbeibu and Iyobosa [16] reported that 7000 oil spill incidents occurred in Nigeria between 1970 and 2000 i.e within a period 30 years, thus, translating to 233 spill incidents annually. According to Twumasi and Merem [21], about 2300m³ of oil was spilled in Nigeria between 1976 and 1996 in 300 separate incidences. Report suggests that over 70% of spill oil are unrecovered [12, 16, 22].

A breakdown of oil spill incidence show that majority occur in offshore (69%), 25% in coastal swamps with only 6% on land. Hence, most literature dealing with the impacts of oil spill focus mostly on marine organisms especially fisheries mammals such as whale, sea turtles [16] and costal mangroves [9, 10, 13]. When oil spill occurs on land, it is quite devastation on burrowing animals like rats and rabbits. Oil spill destroy their habitats (burrows), suffocate them and contaminates their food (forage). Few literatures reported the effects of crude oil on land mammals [11, 14, 26]. But literature on the impacts of crude oil contaminated forage on the reproductive performance of female rabbits is scarce.

Berepubo [4] reported on the growth and organ weights of weaner rabbits exposed to contaminated forage. Hence, due to the paucity of literature on the breeding behavior and reproductive performance of female rabbits exposed to crude oil contaminated forage, this study was carried out.

MATERIALS AND METHODS

Animals procurement

Forty semi-adult female chinchilla rabbits aged 16 – 17 weeks were used for this study. The rabbits initially weighed between 1.30 - 1.42kg. The rabbits were procured from the farm of Rivers State Agricultural Development Programme (ADP) farm (livestock unit), Rumuodomaya in Obio-Akpor Local government area

Pre-experimental management of animals

The pre-experimental period lasted two weeks during these period all the animals used in this study were subjected to the same management conditions including housing, feeding and medications (i.e antibiotics, coccidiostat and vitamins).

Housing

During the pre-conditioning period, all the rabbits were properly housed in hutches. These single tier hutches had three compartments per hutch. The rabbits were kept two per compartment. These single tier conventional hutches were made of wire mesh and wooden frame. The compartments were large enough to accommodate about four rabbits each. All the hutches were housed in a single room (shed) under the same environmental condition. This made it convenient for the experiment. All the hutches and animals were properly identified on individual basis using identification tags.

Feeding

All the rabbits during the two weeks of pre-conditioning were given the same feed and water. Feeders and drinkers in the hutches which were made of heavy clay to prevent over turning and spillage of feed and water by the rabbits. The animals were fed *ad libitum* with feed made of green forage prepared from mixture of commonly available grasses and legumes. The forage was supplemented with concentrate feed to boost their nutrition and enhance their sustenance [1, 7]. The green forage fed to these rabbits composed of *Panicum maximum* (Guinea grass), *Brachiaramutica* (Para grass), *Centroema pubescens* (Centro), *Puereria phaseolides* (Pecero), *Calapogonium muconoides* (Calapo) and *Aspiria africana* (Bush marigold). The concentrate feed supplement was the grower's mash as recommended by Ibeawuchi and Fajuyitan [8]. Clean and cool water was provided *ad libitum* on daily basis. The feeding and drinking troughs were cleaned and washed on daily basis and also disinfected as often as necessary.

Medication

During pre-conditioning, all the animals were administered prophylactic coccidiostat (25% embazin) as well as broad spectrum antibiotics like terramycin soluble power. Some vitamin drugs like biovite were also administered to the rabbits. These drugs are to protect the animals from some common rabbit diseases that would have attacked the animals and interfered with the study during the experimental period.

Crude oil source and means of contamination

The crude petroleum used in this study in the Bonny light grade obtained from Nigeria Agip Oil Company (NAOC) at Obrikom flow station in Ogba-Egbema-Ndoni local government area of Rivers state. Prior to actual commencement of the study and contamination of the forages, the crude oil was exposed for 24hours in shallow pans to allow evaporation of the light fraction in order to ensure a stable product [25]. This was to stimulate naturally occurring conditions following oil spillages in the oil bearing communities.

Experimental design

The completely Randomized Design (CRD) experimental method was used for this study. The use of the CRD experimental design was based on the fact that the subjects (animals) in this study were homogenous.

The forty female rabbits used for this study were randomly divided into five groups (Table 1) of eight animals per group representing one control group and four treatment groups (A, B, C, D and E). Group A served as the control group. The forty rabbits were therefore randomly allocated to the five dietary groups including the control (A). Each treatment group comprised of four replicates with two animals per replicate giving a total of eight animals per treatment group. The duration of the experiment was 24 weeks.

Table 1: Graded oil composition in the forage

Treatment No	% oil composition of forage	Mass composition
Treatment A	Plain feed with contamination (0.0% crude oil)	-
Treatment B	0.05% crude oil contamination	0.5g crude oil/kg of forage
Treatment C	0.10% crude oil contamination	1.0g crude oil/kg of forage
Treatment D	0.15% crude oil contamination	1.5g crude oil/kg of forage
Treatment E	0.20% crude oil contamination	2.0g crude oil/kg of forage

Diet mixture and levels of contaminated crude oil inclusion

The use of these levels of crude oil contamination in this study was informed by the results of a study reported by Berepubo [4] showing that these dose of crude oil are not too lethal compared to the pilot study of Johnson [11] that reported a high mortality of 25 out of 32 rabbits (78.13%) used in the experiment was recorded within one week of administration of the crude oil at the different level of 1%, 2%, 3% contamination. It therefore suggests that the above levels of crude oil contamination/ingestion by animals are highly lethal. Hence, lower concentration were used in this study (Table 1).

On commencement of the experiment, all the animals from the various treatment groups were then fed forage contaminated with the graded levels of crude petroleum. The contamination of the forage was done by incorporation of the measured amounts of crude oil in the forage by simple mixing and homogenization for at least two hours to ensure imbibition. Rabbits in treatment, A which serve as the control group, were not however fed the crude oil contaminated forage. They were fed crude oil free forage. In addition to forage, all the rabbits in the various group (A – E) were fed of commercial growers mash [8]. The supplementation of concentrate feed was to provide basic required nutrients in order to avoid malnutrition and its attendant effects. The concentrate was not however given to the rabbits until a substantial proportion of the test feed have been eaten by rabbits in the treatment groups (B – E).

Detection of breeding and reproductive performance

Litter size and litter weight

Litter size was determined by the number of fryers kindled by the rabbits bred. This was done by counting the fryers and thereafter summed up on treatment basis as litter size. The litter weight was determined by weighing fryers kindled by does immediately after kindling.

Kindling weight and weaning weight

The fryers kindled were weighed immediately after birth to determine the kindling weight. The kittens were weighed again during weaning time to determine their weights at weaning.

Live birth and still birth

Data on these parameters were generated by noting the number of fryers kindled by individual doe alive per treatment group and also observation of fryers kindled dead.

Gestation length

Gestation length for the rabbit was determined by noting the difference in date of mating a doe and the kindling date for each of the doe bred.

Simply put this: Gestation length = Kindling date – mating date

Acceptance by males, Pregnancy, Pseudopregnancy, Kindling in pregnancy

These parameters were assessed by observation.

Statistical analysis

Descriptive statistics (i.e. proportion) was done Microsoft Excel 2007 (Microsoft Inc).

RESULTS AND DISCUSSION

Result obtained from the reproductive performance of does exposed to crude oil contaminated forage are presented in Table 2. Findings from this study indicate that all the female exposed to males for mating in group A (control) accepted the males (100.00%), whereas none (0.00%) of those in group E accepted the males for mating. Further evaluation of the acceptability status of the males by the does indicated that 50.00% females in group B accepted the males; 66.67% out of the males in group C, while only 33.33% of group D accepted the males for mating. Pregnancy results indicated that 83.33% in control group became pregnant. No pregnancy was however observed among females in all other treatments (B, C, D and E). The pseudopregnancy result as shown in Table 2 reveals that out of the total of 13 does that accepted males in the five groups (A – E), 7 of the animals exhibited pseudopregnancy. The result showed that 2 does from treatment C and D that accepted males exhibited pseudopregnancy, 3 mated females in treatment B exhibited pseudopregnancy, while only one does out of the 6 females mated in group A (control), exhibited pseudopregnancy and represented 16.67%. Table 2 also showed the kindling rate of the pregnant females, which indicated that all (100.00%) of the pregnant females in the control group kindled. Table 3 presents the effect of crude oil contaminated forage on breeding performance of female does. The results indicate that the gestation length of the pregnant rabbits in the control group was 30.80 days and 83.33% of does in the control group (A) kindled. None of the animals in treatments B, C, D and E kindled. The results on litter size indicate that a total of 27 fryers were kindled by does in the control group with a mean litter weight of 390.00g. The average weaning weight for these kittens was 920.00g.

Table 2: Effect of crude oil contaminated forage on reproductive performance of female rabbits

Parameter	Treatment , %				
	A	B	C	D	E
	Control	0.05	0.10	0.15	0.20
Acceptability of males	100.00	50.00	33.33	33.33	0.00
Pregnancy	83.33	--	--	--	--
Pseudo-pregnancy in does bred	16.67	50.00	33.33	33.33	--
Kindling in Pregnancy does	100.00	--	--	--	--

Table 3: Effect of crude oil contaminated forage on breeding performance of female rabbits

Breeding trait	Treatment (%)				
	A	B	C	D	E
	Control	0.05	0.10	0.15	0.20
Gestation length (Days)	30.80	--	--	--	--
Litter size	27	--	--	--	--
Litter weight (g)	390.00	--	--	--	--
Weaning weight (g)	920.00	--	--	--	--
Conception rate, %	83.33	--	--	--	--
Still birth	--	--	--	--	--

Observations on breeding performance of does in this study showed some interesting features. The results showed a clear and conspicuous influence of the treatment factor (crude oil) acting as a stressor on the breeding performance of the does fed the graded levels of crude oil contaminated forage. It was observed that during breeding or mating, all the rabbits (100.00%) in the control group willingly accepted the courting and mating advances by the bucks which they were introduced to. Does in the control group enjoyed male companionship and mated freely with them. All the mated does except one became pregnant and later kindled. Only one exhibited pseudo-pregnancy. On the other hand, does which some strength had never hesitated to fight whenever introduced into a male hutch. Some others simply sat still in a position and would not accept the males at all (group E). In treatments B, C and D, some level of receptivity was observed among the does although most of them were assisted (i.e. assisted mating). The poor receptivity among these does could be inferred to be the culminated effects of the reported poor hormonal production and underdevelopment or reduced organs especially reproductive organ development not functioning efficiently. This finding agrees with earlier studies reported by Paufler [19] and Berepubo and Umanah [3]. Another interesting observation also made in this study was the fact that even the does mated among the treated groups neither conceived nor kindled. Pseudo-pregnancy rather ensued in such does. This feature indeed confirmed the devastating effects of the toxic components of the crude oil ingested by the tested does. It also confirmed the stressful effect of the hydrocarbon in the system of these tested does interfering especially with the reproductive systems. An obvious fact has long been established that a high correlation exists between organs and size and its size function especially in the reproductive organs. In this light, Paufler [19] and Berepubo [4] have reported that reduced testis weight could be associated with sub infertility. This means that high correlation exists between testicles size and spermatogenesis (sperm production). This fact is also true in the female, where high correlation also existed between ovarian size and oogenesis (egg or ovum production), and could imply sub fertility. There is therefore, no doubt that the decrease in size and atrophy of follicles observed in ovaries of the tested does could be associated with sub fertility resulting in the no-conception rate observed among them. Against this poor conception results in the crude oil treated does, the control rabbits showed 83.33% conception rate. This observation is also in conformity with those of Plyaschenko and Sidorov (1987) who reported that crude oil is an environmental stressor, which causes relative ovarian quiescence.

Against the backdrop of the above discussion on the negative effects of crude oil ingestion on the reproductive performance of female rabbits, no further breeding parameters were observed and recorded among the does in the treatment groups. However, some more reproductive parameters were monitored in rabbits of the control group. Results therefore revealed that the mean gestation length of the bred and conceived does lasted for 30.80 days which is in consonance with 29 -31 days gestation period reported previously by other researchers [2, 5, 6, 7, 19]. The result also indicated an average litter size of about 5 fryers with an average litter weight of 390.00g. Weaning, which is the separation of the kittens from the does (mothers) concluded this study. It was observed that the kittens attained a mean weight of 920.00g when they were weaned. No still birth was however, recorded among the does during kindling, while the experiment lasted.

CONCLUSION

Environmental impacts of oil spill on land animals could be devastating. This study tested the impacts of oil contaminated forage on the reproductive performance of female rabbits. Results show that oil contaminated forage result in decreased acceptance of males, no pregnancy and increased pseudo-pregnancy. It can therefore be concluded that oil spill can cause reproductive failure in rabbits, which could affect their sustainability.

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