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Sexual receptivity and reproductive performance of rabbit does administered exogenous GNRH, Ovaprim[tm]

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***Target Audience:** Animal Physiologists, Farmers, Researchers, Veterinarians.*

Abstract

Twenty-seven (27) nulliparous rabbit does aged 6 - 7 months were subjected to a study to evaluate the effect of Ovaprim[TM], an exogenous gonadotropin-releasing hormone (GnRH) on their sexual receptivity and reproductive performance. The animals were randomly selected and assigned into three treatment groups in a completely randomized design; each treatment consisting nine animals divided into three replicates with 3 animals per replicate. The GnRH was injected intramuscularly at the rates of 0.0ml, 0.5ml and 1.0ml /kg body weight respectively, across the 3 treatment groups. Ovulation in the control experiment was induced using vasectomized bucks. The does were inseminated using freshly collected and diluted semen, 3 hours after administration of the GnRH. Parameters measured were sexual receptivity, conception rate (%), litter size, stillbirth (%), pre-weaning mortality rate and body weight of does and litter (g) at birth and at weaning (42 days). Sexual receptivity was measured and scored on a graded scale of 1 - 5. Results showed significant differences (P<0.05) between the treatments on sexual receptivity, conception rate, and litter weight at weaning. Litter size, litter weight at birth and pre-weaning mortality were not significantly different (P>0.05) among treatments. Sexual receptivity and conception rate were shown to improve after administration of 0.5ml of Ovaprim per kg body weight. In conclusion, exogenously added GnRH, Ovaprim[TM] had minimal effects on body weight index and reproductive performance of rabbit does. However, a higher dose of 1.0ml/kg body weight led to a decline in performance suspected to be associated with a negative feedback mechanism.

***Keywords**: exogenous, hormones, nulliparous, adenohypophysis, insemination*

Description of Problem

Efficient reproduction is key to the success of any livestock enterprise. With high deficiency in animal protein consumption, rabbits demonstrate good potential as meat producing animals and with great prospect for combating shortages in animal protein in developing countries, considering their high productive and reproductive capability.

Several research efforts have been made in the recent past, targeted towards enhancing the reproductive performance of farm animals through scientific approaches involving some kind of genetic, nutritional and physiological manipulations or interventions (1, 2, and 3). Hormonal deficiencies have been implicated in some cases of reproductive failure in rabbit does (4). It was also noted that (4), that some 20 to 25 percent of does fail to ovulate after copulation, probably due to Luteinizing hormone (LH) deficiency in the pituitary gland; thus ovulation can be induced by

injecting some hormones intravenously. The non-conception and low conception rates might be attributed to some physiological problems in the does (1). Reproductive processes in animals are under the influence of gonadotropic and steroid hormones regulated by the hypothalamus and pituitary glands in the brain.

This study evaluates the effect of an exogenous GnRH, Ovaprim™ on reproductive physiology of rabbits does with emphasis on sexual receptivity and reproductive efficiency. Ovaprim™ has been used extensively for inducing gonadal recrudescence and ovulation (spawning) in female fishes and boosting milt (sperm) production in the males (5).

Materials and Methods

Experimental site

The experiment was conducted at the Rabbitry Unit of the Teaching and Research Farm of Michael Okpara University of Agriculture, Umudike, Abia State. Umudike is located within the tropical rainforest zone, between latitude 05^0 29^1 north and longitude 07^0 33^1 east; the environment is characterized by an annual rainfall of 2177mm.

Experimental animals and management

Twenty seven (27) nulliparous Dutch-belted rabbit does aged 6-7 months were used for this study. The animals were purchased from reputable rabbit breeders and quarantined for a period of three (3) weeks before commencement of the experiment. The animals were housed in individual cells in wooden hutches and fed concentrate ration of 16% crude protein and 2630 ME/kg energy; alongside grass-legume forages. Fresh clean water was provided *adlibitum.*

Table 1: Percentage composition of concentrate ration for experimental animals.

Ingredients	% Composition
Maize	38.00
Maize offal	10.00
Soybean	14.00
Wheat offal	20.00
Palm Kernel Cake (PKC)	14.00
Bone meal	3.25
Salt	0.50
Vitamin Premix	0.25
Total	100.00
Calculated Crude Protein, CP (%)	16.00
Metabolizable Energy, ME (Kcal/kg)	2630.00

Experimental design and procedure

The rabbit does were randomly selected and assigned into three (3) treatment groups designated as T_1, T_2 and T_3; each treatment consisting nine (9) animals. The treatments were replicated 3 times with 3 animals per group. The exogenous GnRH, Ovaprim™ was administered early in the morning at the rates of 0.0ml, 0.5ml and 1.0ml per kilogram body weight for T_1 (control), T_2 and T_3 respectively. Ovulation in T_1 was induced using vasectomized bucks. The does were inseminated using 0.5ml of freshly collected and diluted semen with the aid of a catheter attached to a sterile syringe; this was done 3 hours after administration of the GnRH. The semen used was collected from mature rabbit bucks with the aid of an artificial vagina. Ovaprim™ is a product containing Salmon gonadotropin releasing hormone (GnRH)

analogue, produced by Western Chemical Inc., Ferndale; for Syndel Laboratories Ltd. Canada.

Data collection and analysis

Body weight (kg) of does were measured before insemination using a weighing scale. Parameters measured were: sexual receptivity, gestation length (days), conception rate (%), litter size and weight, pre-weaning mortality rate. Gestation length was determined by calculating the time interval (in days) between the insemination date and the date of parturition (kindling). Conception rate was determined using the relationship below:

$$\text{Conception rate} = \frac{\text{Number of does that conceived}}{\text{Number of does inseminated}} \times \frac{100}{1}$$

Sexual receptivity was scored on a scale of 1-5 by monitoring the readiness of the doe to mate, as signaled by signs of oestrus, such as: Swelling and coloring of the vulva, rubbing of the chin on the walls of the hutch and other hard objects, exposition of the rear quarters / raising of the tail and lordosis.

Table 2: Sexual receptivity scores and grading for experimental does.

Score	Grading
5	Highly receptive
4	Receptive
3	Fairly receptive
2	Poorly receptive
1	Non receptive

The experiment was conducted using a completely randomized design (CRD). Data generated was subjected to Analysis of variance (ANOVA) according to Steel and Torrie (6). Significant means were separated using Duncan's multiple range Test (7).

Result and Discussion

The data obtained from the study on the sexual receptivity and reproductive performance of rabbit does following administration of varied doses of Ovaprim are presented in Tables 3.

There was no significant difference ($P>0.05$) observed in sexual receptivity between T_2 (4.33) and T_3 (4.33). However, these two treatments differed significantly ($P<0.05$) from the control, T_1 (2.67). This difference observed for sexual receptivity in this study could be traceable to estrus in the does, brought about by the action of gonadotropic hormones (FSH and LH) on their gonads, consequently leading to the synthesis and release of estradiol (estrogen) which is responsible for initiation and control of oestrus behaviour in female animals.

Table 3: Sexual behaviour, reproductive performance and body weight index of rabbit does injection.

Parameters	T_1	T_2	T_3	SEM
Doe weight at insemination (kg)	2.09	2.03	2.07	0.05
Sexual receptivity (0 – 5)	2.67[b]	4.33[a]	4.33[a]	0.32
Conception rate (%)	33.33[b]	66.67[a]	44.44[b]	17.57
Gestation length (days)	30.53	29.20	30.00	0.29
Ave. litter size at birth (No.)	5.33	6.33	5.67	0.22
Litter weight at birth (g)	245.91	241.15	239.73	3.41
Litter size at weaning (g)	3.00	4.67	3.67	0.36
Litter weight at weaning (g)	1190.41[b]	1749.68[a]	1488.29[ab]	103.37
Pre-weaning mortality rate (%)	44.44	26.19	39.52	4.25

ab: Means with different superscripts within a row are significantly different ($P<0.05$).
Treatment 1: Control (Ovaprim™ at 0.0ml/kg); Treatment 2: GnRH (Ovaprim™ at 0.5ml/kg)
Treatment 3: GnRH (Ovaprim™ at 1.0ml/kg)

Under regulation by gonadotropic hormones, ovarian follicles mature and estrogen secretions exert their biggest influence; the female then exhibits sexually receptive behaviour, a situation that may be signaled by visible physiologic changes (8). It is suspected that the exogenous hormone, Ovaprim™ used in this experiment may have stimulated the anterior pituitary gland bringing about the release of the gonadotropic hormones.

Conception rate was 33.33, 66.67 and 44.44 % in T_1, T_2 and T_3 respectively. T_2 was significantly ($P<0.05$) higher than T_1 and T_3. T_1 and T_3 were similar, though T_3 recorded a higher numerical value of 44.44 % as against 33.33 % in T_1. Conception rate was highest in T_2 (66.67 %). The conception rate as observed in this study tend to decline with increase in the dosage of the Ovaprim injection as observed between T_2 (0.50ml of Ovaprim/kg body weight of doe) and T_3 (1.00ml of Ovaprim/kg body weight of doe). This decline in conception rates following an increase in the dosage of Ovaprim is suspected to be associated with an inhibitory action by the pituitary gland preventing further release of gonadotropins in connection with a negative feedback mechanism initiated as a result of an increased level of the gonadotropins in the blood brought about by a higher dose of the exogenous GnRH. A lower conception rate recorded the control experiment (T_1) could be associated with a lower sexual receptivity recorded in the T_1 during this study. Gestation length across the various treatments in this study varied within a narrow range. There was no significant difference ($P>0.05$) between T_1 (30.53), T_2 (29.20) and T_3 (30.00) for gestation length. However, T_1 (30.53 days) gestation period was observed to be numerically highest, while T_2 had the lowest value (29.20 days). A slightly lower value obtained in T_2 is traceable to a relatively higher litter size at recorded at birth. This is in agreement with (9) who observed that larger litter tends to have shorter gestation length. Decrease in gestation length show a significant correlation with large litter size in rabbits (10). Gestation lengths in this study were lower than 33.00 and 32.17 days recorded by (11). There were no significant differences ($P>0.05$) in average litter size between T_1 (5.33), T_2 (6.33) and T_3 (5.67). The average litter size observed in this study tended to increase following the administration of Ovaprim, suggesting that the hormone may have influenced the number of ova shed

during ovulation through its influence on the synthesis and secretion of the gonadotropins and steroid hormones. The maximum potential litter size depends on number of ova released (12). Litter sizes recorded in this study were higher than 4.00 – 5.20, recorded by (13) respectively. Litter weights at weaning were T_1 (1190.41g), T_2 (1749.68g) and T_3 (1488.29g). Values obtained for live weight at weaning in T_2 differed significantly from T_1 ($P<0.05$) while T_3 was similar ($P>0.05$) to T_1 and T_2. The values obtained for pre-weaning mortality in T_1 (44.44%), T_2 (26.19%) and T_3 (39.52%) were not significantly different ($P>0.05$) from each other.

Conclusion and Applications

1. Reproductive processes; folliculo-genesis, estrus, ovulation, pregnancy and parturition are regulated by gonadotropic and steroid hormones synthesized and released by the pituitary gland and the gonads. These secretory functions of the pituitary gland are controlled by the action of gonadotropin-releasing hormones secreted by the hypothalamus.
2. Observations and results obtained from this study suggest that the exogenous GnRH, Ovaprim™ when used at the rate of 0.5ml/kg can influence sexual receptivity and conception rate in the rabbit does. Furthermore, no stillbirth, abortion, premature parturition or any abnormal condition emanated from administration of the hormone, implying that the product had very minimal or no deleterious effect on the rabbits.

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