

# Global Productivity of Rabbit Does (*Oryctolagus Cuniculus*) Following Oestrus Synchronization, Natural Service and Artificial Insemination

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## Abstract

Knowledge of the rabbit reproductive pattern would go a long way in boosting the productivity potential of rabbits in Nigeria. This work was aimed at determining the global productivity of rabbit does (*Oryctolagus cuniculus*) following oestrus synchronization, natural service, and artificial insemination. Forty adult rabbits were used to carry out studies on the global productivity of rabbit does following oestrus synchronization, artificial insemination and natural service. They were divided into four groups designated as natural service (NS), Artificial Insemination (A.I), Natural service + Gonadotropin (NS + GnRH), Artificial Insemination + Gonadotropin (A.I + GnRH). The NS + GnRH and A. I + GnRH rabbit does were synchronized using 0.5 ml Gonadotropin-Releasing Hormone (GnRH) analogue (Lecirelin) i.m injection at point of insemination/Service. Oestrus response rate, fertility rate, prolificacy rate, conception rate, and global productivity were determined. 10 % of the does which showed flattening, circling and aggression were all classified under indications of unwillingness to mate. Lordosis was observed in 70 % of the does while 20 % of the does allow mounting without lordosis. The fertility rate of rabbits does to natural service was 63.3 % and artificial insemination was 50 % following oestrus synchronization (hormonal and non-hormonal). The prolificacy rate obtained was 652.6 % and 593.6 % for natural service and artificial insemination. The conception rate was 63.3 % for natural services and 50% for artificial insemination. It was concluded that the Oestrous response rate of rabbit does to synchronization improved by 44.44 % in hormonal (GnRH) than the non-hormonal methods. Natural service showed an improvement in the fertility rate by 21.01 % as compared to artificial insemination following oestrus synchronization (hormonal and non-hormonal).

**Keywords:** Rabbits, Birth rates, Fertilization, Lordosis, Insemination

## Introduction

Rabbits are small mammals in the kingdom: Animalia, Phylum: Chordata, Subphylum: Vertebrata, Class: Mammalia, Family: Leporidae and of the order Lagomorpha with eight different genera in the family (*Pentalagus*, *Bunolagus*, *Nesolagus*, *Romerolagus*, *Brachylagus*, *Syvilagus*, the European rabbit (*Oryctolagus cuniculus*) and the *Poelagus* (1). They are mainly kept by people in the tropics as a source of food and or as a source of income which could bridge the gap between demand and supply. Rabbit production has been reported as an appropriate system for a nation to attain self-sufficiency in meat production (2, 3), and is gradually becoming an important source of income and employment in Nigeria (2). When raised with proper technologies, the rabbit can contribute significantly in the improvement of the diet of families; and eventually serve as an alternate source of animal protein to mitigate the negative impacts of malnutrition prevalent in the developing countries (4).

Rabbits are potentially a cheap source of producing white

meat, which could be comparable to domestic chickens because of the short gestation and generation interval, highly prolific, lack of taboos to its production and consumption, and can subsist on domestic waste and succulent leaves (2).

For successful livestock production, optimum reproductive performance is considered to be necessary, considering that it could be greatly affected by factors such as genetics, physical environment, nutrition, health and management (5).

Reproductive activity is controlled by the neuroendocrine axis. Ovulation does occur at coitus or when induced through a neurohormonal reflex, which is initiated during natural mating (5). When artificial insemination is used in the absence of a male, ovulation can be induced by exogenous hormonal stimulation. The ovulation-inducing method most frequently used is an intramuscular administration of gonadotropin-releasing hormone (GnRH) (6), although other substances (or hormones) such as pregnant mare serum gonadotropin (PMSG), equine chorionic gonadotropin (eCG) and prostaglandin F<sub>2α</sub>,

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(PGF2 $\alpha$ ) could also be used. With increasing animal welfare concerns, emphasis have been made to find alternate ways of inducing ovulation in rabbit does, amongst the non - hormonal methods, doe-litter separation (DLS), buck effect, animal manipulation (change of cage/doe gathering), feeding Programme, light stimulations, feed flushing, vitamin supplements in feed and water and lightning programs could also be used (6). The present study was designed to determine the global productivity of rabbit does following oestrus synchronization, artificial insemination and natural service.

## Materials and Methods

### Animals

Forty (40), apparently healthy female rabbits (does) and twenty (20) male rabbits (bucks) (*Oryctolagus cuniculus*) encompassing the New Zealand White, Dutch, Gray, Chinchilla and California breeds, aged 8 - 12 months, weighing between 1.8 and 3.5 kg ( $2.8 \pm 0.07$  kg) belonging to the Rabbitry Section of the National Animal Production Research Institute (NAPRI) Shika, Ahmadu Bello University Zaria were used for the experiment.

### Housing

They were housed individually in standard flat deck cages with internal nest boxes using standard rabbit husbandry methods.

### Feeding

The animals were fed on an 18 % crude protein and energy feed ration of 2,700 ME/Kcal/kg, and forage (sweet potato stem and groundnut haulms) throughout the experimental period and water was given ad libitum. The animals were allowed to acclimatize in the rabbitry facility for four weeks; during which the animals were weighed, examined for ectoparasites and screened for common parasitic and other diseases before the commencement of the experiment. The infected animals were treated appropriately with subcutaneous injection of Ivermectin 1% (0.2ml/rabbit) and Sulfadimidine Sodium 0.3 to 0.6 ml per kg of live body weight for three days, before their inclusion in the study or removed. The animals were individually identified by ear tattoo. Approval for this study was sought and gotten from the Ahmadu Bello University committee for animal use and care.

### Semen

The semen used for the experiment was collected using a specially designed artificial vagina for rabbits by IMV Technologies 2911 model North Maple Grove, U.S.A. The ejaculated semen sample was subjected to routine semen evaluations such as semen volume, pH, colour, spermatozoa concentrations, motility, live/dead ratio and morphology (7) with slight modifications (5).

### Experimental grouping

The rabbit does were divided into four groups of 10 rabbit does each, designated as natural service (NS), Artificial Insemination (A.I), Natural service + Gonadotropin (NS + GnRH), Artificial Insemination + Gonadotropin (A.I + GnRH). The NS + GnRH and A.I + GnRH rabbit does were

synchronized using 0.5 ml Gonadotropin-Releasing Hormone (GnRH) analogue (Lecirelin) i.m injection at point of insemination/Service. Each group of rabbit does were monitored for oestrus identified by rabbit does that exposed their rear quarters and stood to be mounted. Oestrus response rate, fertility rate, prolificacy rate, conception rate and global productivity of the rabbit does were determined.

### Receptivity

Receptivity was assessed by lordosis test and the redness/turgidity of the vulva.

### Fertility Rate

The fertility rate was determined as the number of kindlings arising from the total number of inseminations and natural service and was expressed in percentages. It was calculated thus: Number of kindling/ number of inseminations (for artificial insemination). A number of kindling/number of services (for natural service).

### Prolificacy rate

Prolificacy rate: was calculated as the number of kits born per the number of does that kindled multiplied by 100 and expressed in percentages, i.e (Number of Kits born / per number of does delivered) X 100.

### Conception rate

Conception rate: number of does that conceived x 100/total number of does mate expressed in percentage. Global productivity was calculated as a number of weaned rabbits per 40 does for artificial Insemination and natural service.

### Data Analysis

Data obtained were expressed in percentages and as mean  $\pm$  standard error of the mean ( $\pm$ SEM). The differences between variables were analyzed using one-way analysis of variance (ANOVA), and Tukey's post hoc test was used to compare the mean values between the groups. Graphpad prism version 5.0 for Windows was used for all statistical analyses. Values of P were considered significant at  $\leq 0.05$ .

## Results

Does which showed flattening, circling and aggression were all classified under indications of unwillingness to a mate of the forty does was 4 (10 %) of the does. Lordosis which is indicative of a willingness to mate was observed in 28 (70 %) of the does, while 8 (20%) does allow mounting without lordosis but was considered to be in oestrus. This is illustrated in figure 1.

Figure 2 presents the fertility rate of rabbit does. The fertility rate did not differ significantly ( $P \leq 0.05$ ) between the natural service with 63.3 % and artificial insemination with 50 % following oestrus synchronization (hormonal and non-hormonal).

Prolificacy the rate obtained was 652.6 % and 593.6 % for natural service and artificial insemination while conception rate was 63.3 % and 50 % for natural service and artificial insemination; this is shown in table 1.

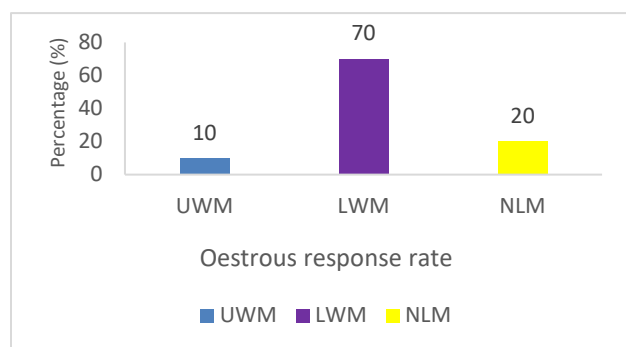


Figure 1: Oestrus Response Rate of Rabbit Does to Synchronization n = 40 ( $P \leq 0.05$ ) SEM using Hormonal (GnRH) and Non-hormonal (Doe-litter separation) Methods.

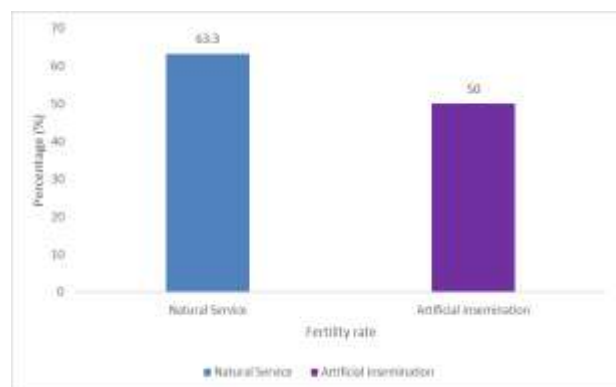


Figure 2: Fertility Rate of Rabbit Does to Artificial Insemination and Natural Service n = 40, ( $P \leq 0.05$ ) SEM following oestrus Synchronization (Hormonal and Non-hormonal).

**Table 1: Reproductive Indices for Fertility and Prolificacy of Rabbit Does Following Oestrus Synchronisation, Artificial Insemination and Natural Service (%)**

Parameter	Natural Service	Artificial Insemination
Prolificacy rate (%)	652.6	593.6
Conception rate (%)	63.3	50
Weaned Rabbits (No)	78 (3.9)	58 (2.9)

## Discussion

The oestrous response rate of rabbit does to synchronization improved in hormonal (GnRH) than the non-hormonal methods. Natural service showed an improvement in the fertility rate as compared to artificial insemination following oestrus synchronization (hormonal and non-hormonal).

Rabbit does have a cycle of mating receptivity which is about 14 of every 16 days; therefore does who were not receptive to the male were probably not cycling which is similar to some reports (4, 8). The observed pattern of willingness to mate or lordosis which was observed in the doses used in this study corresponds with other authors who recorded positive oestrus response rate by does that showed lordosis (9).

The differences in the prolificacy values obtained in the rabbit do during this study, which was higher in the natural service group than in the artificial insemination group may be attributed to the timing and technicality with instrumentation for the artificial insemination, as artificial insemination in rabbits in Nigeria is a new tool to be explored, and also individual genetic make - up of the does leading to a lower prolificacy value for artificial insemination (10).

The differences in conception rate for the natural service and artificial insemination groups may be as a result of the mating methods used and also breed differences. The result compares favourably with the range observed by (10, 11, and 12), however, values were lower than that obtained by (13, 14 and 15) who reported higher conception rates of 98.8 and 68.4 %, 96 and 99 %, 85 % respectively.

## Conclusion

In conclusion, it is possible for a doe not to exhibit the characteristic sign of willingness to mate (lordosis), but will mate if taken to a buck. Oestrous the response rate of rabbit does to synchronization improved by 44.44% in hormonal (GnRH) than the non-hormonal methods.

Natural service showed an improvement in the fertility rate by 21.01% as compared to artificial insemination following oestrus synchronization (hormonal and non-hormonal).

## Conflicts of interest

The authors declare that there is no conflict of interests.

## Ethical approval

All applicable international, national and/or institutional guidelines for the care and use of animals were followed. Approval for this study was sought and gotten from the Ahmadu Bello University Committee for animal use and care.

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