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The Assessment of Artificial Breeding Pattern on Fertility in Rabbit Does In the Humid Tropics

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Abstract: *A study was conducted to determine the impact of artificial mating frequency on fertility of adult rabbit does. Twenty seven (27) adult post pubertal fertile does and (3) fertile bulks with an average weight of 2.8kg were randomly assigned to three (3) experimental groups in a Completely Randomized experimental design (CRD) as follows: Treatment A-C indicated increasing levels of daily artificial mating of once a day (treatment A- the control), twice daily (treatment B) and thrice daily (treatment C) artificial mating patterns. The experiment lasted for twelve weeks, during which two parities were obtained. From the results, Conception rate and litter size were significantly affected by the artificial mating pattern (P < 0.05). The highest conception rate and litter size was recorded in Group C (33.33%, 4.5) more than Group B (11.11 and 3.0). No conception rate and litter size was recorded in treatments A. Gestation length was not significantly affected by the artificial mating frequency (P > 0.905). Their values are 0.00 days, 32.0 days and 31.5 days for treatments A, B and C respectively. Liter weight was not significantly affected (P < 0.05) between the treatment groups. Treatments A B and C had litter weights of 0.00 grams, 43.38 grams, and 40.13 grams respectively. No mortality was recorded in all the groups. Kids mortality was experienced in treatment B (1 kid) and C (2.00) and non was recorded in A. Pseudo pregnancy was recorded in Group A (3) and B (1), non in C (0.0). No case of abortion was experienced during the experiments between the groups. It was concluded therefore that daily artificial breeding pattern was not beneficial to reproductive performance of rabbit examined in this study.*
Keyword: *Breeding, Rabbit Doe Artificial vagina, humid tropics*

I. Introduction

The rabbit (Oryctolagus cuniculus) belongs to the family Leporidae (rabbits, hares) of the order Lagomorpha (Leporids, picas). The age at which sexual maturity is reached depends on the size and the breed, while small and middle sized rabbits become adult between 4 and 6 months, it may take between 5 to 8 months for giant breeds. As a rule, it is considered that a rabbit is an adult and able to produce when it has reached 75 to 80% of its adult size.

Reproduction is a complex biological phenomenon which occurs in all living organism. Its significance and manipulations are the secret tools for the improvement of animal fertility (Dalton, 1987: Berepubo, et al., 1993).

It is controlled by many factors including hormones, which are produced in endocrine glands and other organs of the body such as the ovary. Different hormones act on different parts of the reproductive system at different times to ensure successful reproduction (Fielding, 1991).Rabbit's sexual behaviour and breeding potential are all influenced by a wide range of external and internal stimuli (Berepubo and Umanah, 1995, Ajuogu 2002; Ajuogu, et al., 2009).

The reproductive organ of the female rabbit is duplex. The uterus is formed by two independent horns, split over their whole length (7cm). Each horn poses its own cervix. The ovaries, ellipsoid bodies that have a maximal length of 1 – 1.5 cm, are located at the end of the uterus, right under the kidneys. They are hidden by the myometrium and fat. The vagina is large, with urethra going halfway, at the level of the vaginal vestibule.

The female rabbit is reputed to have a complex and peculiar reproductive pattern. The female rabbit is also considered poly estrus, or as having no cycle or regular oestrus (Aduku and Olukosi, 1990).

The influence of mating frequency is important in the reproductive performance of farm animals including rabbits, (Ajuogu and Ajayi, 2010) compared the effect of mating on the reproductive performance of rabbit and reported increased conception rate, increased litter size and decreased litter weight. Multiple mating of farm animals has been reported to improve reproductive performance i.e. by increasing the liter size and high conception rates.

Reed (1982) compared fertile result of sows inseminated three times in each oestrus period with those inseminated twice. He reported an increased conception rate and increased litter size. Drugocin (1966) reported

that vaginal uterine stimuli especially with double service had a favourable influence on the ovaries and uterus, resulting in higher prolificacy and greater viability in-vitro.

Artificial collection of semen has greatly enhanced the study of male reproduction in farm animals. The general approaches for semen collection have not changed greatly during the past three decades. These approaches are the use of an artificial vagina, electro-ejaculator and digital manipulations. (Amann and Schanbacher, 1983).

It has been proved that artificial vagina is the best method and is now most commonly used. There are different kinds of artificial vagina for different classes of animal, which are almost similar to that of the natural vagina. Developing countries generally suffer a great dearth of information on the characteristics of rabbit raised in their region. This is because studies on semen collection have been neglected.

Before use, the AV unit was warmed by placing it in a warm water bath of about 40 – 60 oC for 10 – 15 minutes in a container according to Herbert and Adejumo (1996). A mature, non-gravid doe is then used as a teaser. As the buck mounts and makes a thrust on the teaser doe before intro-mission, the penis is grabbed and the AV quickly applied from the side to the erect penis of the buck. The deep thrust of the penis in to the AV will elicit ejaculation within seconds. The semen collects at the centrifuge tube. Thus the success of insemination depends chiefly on proper handling of the semen prior to insemination

Insemination at the right time Proper deposition of semen.

Proper oestrus detection and correct knowledge of insemination time are among the pre-requisites of successful artificial insemination programme. The time of insemination can be determined with an accurate knowledge of duration of oestrus. Poor expression of behavioral symptoms in the female rabbit as well as the nature of physical changes in the reproductive tract makes it difficult to determine the exact and precise time for insemination since the insemination procedure may not initiate enough neural stimulus for induction of ovulation compared to the coital activity of the male rabbit.

Rabbit semen does not respond to dilution as in other farm species mainly because of its sensibility to hypertonic solutions and to cryo-protective agents containing hydroxyl groups such as glycerol.

Recent technique have been improved and refined making simple, usable, predictable tool for controlled breeding programmes, reproduction studies and defined herd development (Adams, 1981), Tawfeek (1991) and El- Gaafary and Mini (1991).

Interest in A1 is increasing in all the countries where intensive rabbit raising is practiced. However large differences in conception rate are commonly obtained even under the same conditions. The advantages of the A1 technique include the reduction in the number of males needed in the rabbit farm, the assessment of semen quality, the synchronization of reproduction in fixed days of the week, and the increase of diseases control. The advantages of A1 have been admitted by El-gaafary (1991), Tawfeek and Elgaafary, (1991).

Rabbit semen does not respond to dilution as in other species mainly because of its sensibility to hypertonic solution, and to cry-protective agents containing hydroxyl groups such as glycerol.

There is a negative correlation between age of doe and conception rate. The virgin does (4 – 5 months of age) usually show excellent conception rate (Sinkovics, et al., 1983). The non-kindled (nullipara) does show high conception rate, while the kindled does (primipara and/or multipara) achieve low conception rate (Szendro and Biro-Nemeth, 1991).

However, some studies show that conception rate was low when insemination of does was carried out during the first lactation following the first parturition as compared to multi-parous female, and high conception rates were obtained with does in forth parity and inseminated directly after kindling (Lange and Schlolout, 1988).

It is difficult to predict the optimal time for insemination. Conception rate is found to be low during the first 15 days after kindling, good between 16 – 40 days and best after weaning (Szendro et al., 1992). Higher fertility rate were obtained following A1 among dried females than among the nursing ones. Although Szendro and Biro-Nemath (1991) stated that conception rate of does inseminated after 60 days of parturition was commonly low due to some does either failed to show estrus or were barren.

Few authors studied the relationship between vulva colour and fertility, with the aim of predicting respectability for A1 purposes. In nulliparous females which are generally receptive, fertility rates are fairly similar regardless of vulva colour. In multiparous does, fertility is higher when vulva colour is pink or red (Theau-Clement and Roustan, 1992). Improvement is about 10% in fertility when inseminating only females presenting red, turgescent pink or turgescent purple vulva (Roca et al., 1986). The number of does kindled following A1 is significantly higher when the vulva colour is red or pink than when the vulva colour is white (El-Gaafary et al., 1991). However, failure in does with pale or white vulva to conceive is well known even after natural mating.

The body weight of the does at the previous kindling does not influence the conception rate until 4.5kg, but above this weight, the conception rate increase by 15 – 20% (Szendro et al., 1983). Seasons of the year affect both natural and artificial mating (Sinkovics et al., 1983), although according to Sinkovics and Haut

(1988), seasonal fluctuations were lower for A1 than natural mating. Higher conception rate was achieved during April and May and lowest during August and September (Szendro and Biro-Nemeth, 1991 and Szendro and Biro-Nemeth, 1992). They also stated that seasonal fluctuations were lower for does inseminated after weaning as compared to those inseminated before weaning.

II. Materials and Methods

The study was conducted at the Rivers State University of Science and Technology teaching and research farm.

Twenty seven (27) adult post pubertal fertile New Zealand white breeds does with an average weight of 2.5kg and three (3) fertile bulks of the same breed, average weight of 2.8kg were randomly assigned to three (3) experimental groups in a completely experimental design (CRD) as follows: Treatment Group A = Morning artificial mating only; Treatment Group B = Morning and afternoon artificial mating; Treatment Group C = Morning, afternoon and evening artificial mating. They were housed in a standard type single tier hutches of 2 compartments each. The males were housed separately from the females in similar hutches until required for mating.

All the rabbits used for the study received similar conditions of management and husbandry including regular washing and disinfection of feeding and drinking troughs, deworming and prophylactic administration of coccidiostat. Water and feed was offered adlibitum. The feed consisted mostly of grass legume mixture (e.g. panicum maximum, Centrosema bubensens and Calopagonium mucunoide) supplemented with commercial concentrate diet according to Berepubo, 1994).

Construction of AV (Artificial Vagina)

A reinforced polyvinyl chloride (PVC) tube with an inner diameter of 2.8cm and an outer diameter of 3.8cm was cut to a length of 3.5cm. This was referred to as the larger tube (LT). A rigid plumbing hose with an inner diameter of 1.7cm and an outer diameter of 2.7cm was cut to the same length and represented the smaller tube (ST). The ST was inserted firmly into one end of the larger tube until about 2.5cm of the former is allowed a total of 6.0cm for the main part of the AV.

The junction between the two tubes Stand RT was sealed with super glue. The second finger of a disposable rubber glove 8.5cm was cut and used as a liner. The liner was inserted into the tube assembled from the top (large end) and overturned on the upper rim of the main AV unit. The over turned liner was lightly held in place with a rubber band 5.0cm in diameter and the other end subsequently pulled through the narrow of the bottom tube and held. Glycerol (anti freezer and lubricator) 5 - 6 ms was poured into the space between the held liner and the tube till it was 2/3 full.

A 15ml centrifuge tube was cut to length of 4.5cm from the bottom to constitute the collecting vessels (courtesy: Herbert and Adejumo, 1996; Ajuogu, 2002).

Ejaculation Procedure/Semen Characteristics

Before use, the AV unit was warmed by placing it in a warm water bath of about 40-60 oC for 10 – 15 minutes in a container according to Herbert and Adejumo (1996). A mature, non-gravid doe was used as a teaser. As the buck mounts and makes a thrust on the teaser doe before intromission, the penis was grabbed and the AV quickly applied from the side to the erect penis of the buck. The deep thrust of the penis into the AV elicits ejaculation within few seconds.

Experimental model

The experimental model adopted in this work is as thus

$Xij = \mu + Ti + Eij$

Where Xij = Observed data

μ = population mean

Ti = treatment effect

Eij = error term.

III. Results

Influence of Artificial mating frequency on the Reproductive Parameters

Reproductive Parameters	Treatments		
	A	B	C
Conception rate (%)	0.00c ± 0.00	11.11b ± 0.00	33.33a ± 0.05
Gestation length (days)	0.00 ± 0.00	32.0 ± 0.00	31.5 ± 0.00
Litter size	0.00 c ± 0.00	3.00c ± 0.00	4.50a ± 0.00
Litter weight (g)	0.00 ± 0.00	43.38 ± 2.25	40.13 ± 4.68
Doe mortality	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00

Kid mortality	0.00 ± 0.00	1.00 ± 0.00	2.00 ± 0.00
Pseudo pregnancy	3.00 ± 0.00	2.00 ± 0.00	1.00 ± 0.00
Abortion	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00

Mean ± SEM in the same row with different superscripts differs significantly ($P < 0.05$).

Conception and litter size was significantly affected by the mating frequency ($P < 0.05$). The highest conception rate and litter size was recorded in Group C (33.33%, 4.5) more than Group B (11.11 and 3.0). No conception and litter size was recorded in treatments A.

Artificial mating affected the groups according to the increasing order of matings (Table 3.3 above). Gestation length was not significantly affected by the artificial mating frequency ($P > 0.905$). Their values are 0.00 days, 32.0 days and 31.5 days for treatments A, B and C respectively.

Liter weight was not significantly affected ($P < 0.05$) between the treatment groups. Treatments A B and C had litter weights of 0.00, 43.38, and 40.13 respectively. No mortality was recorded in all the groups. Kids mortality was experienced in treatment B (1 kid) and C (2.00) and non was recorded in A. Pseudo pregnancy was recorded in Group A (3) and B (1), non in C (0.0). No case of abortion was experienced during the experiments between the groups.

IV. Discution

Artificial mating, which had low conception rate of 33.33 maximum even though it significantly highest between the treatment groups ($P < 0.05$) suggest that artificial mating in rabbits have very poor influence on some of the reproductive indices (conception rate, litter size and litter weight). This may be related to the fact that the process of artificial mating may not produce enough stimulation to cause ovulation, but two and three times mating may have tactily stimulating the ones that conceived that gave rise to 11.1% and 33.3% conception rate respectively. This also supports the earlier reports that rabbits are induced ovulators.

Quinlela et al. (2003), reported that in rabbits ovulation does not occur spontaneously, but it has to be induced through a neuro-hormonal reflex. They suggested that in the absence of the male, ovulation has to be initiated through the use of drugs. Szendro and Biro-Nemeth, (1991) report that it is difficult to predict the optional line for insemination. So apart from the suspected little or non-neurohormonal reflex from artificial mating that resulted to poor reproduction efficiency. Ajuogu and Ajayi. (2010) also reported few disadvantages artificial insemination in rabbit has i.e. it require a higher level of management than natural services mating systems. For example there is greater chance of human errors associated with A1 than with natural services. So, this may have interplayed with other factors as asserted by Paufler (1985) that improvement in reproductive performance (conception rate) through artificial insemination is possible with very careful attention to hygiene, proper apparatus, expert execution of the insemination and other environmental influences. Report of Paufler (1985), Berepubo et al. (1993), Ajuogu and Ajayi (2010) revealed that rabbits are under a rhythmic weekly estrus cycle (5 – 7 days). This may probably be the reason for the 11.1% and 33.3 conception rate recorded in treatments B and C. the insemination may have been coincidental on their estrus period, since there was no tactile or physiological stimulation. Rahajo et al. (1986) similarly observed poor conception rate in artificial inseminated rabbits without the use of drugs. He implicated lack of induction of ovulation as responsible.

Nonetheless artificial insemination in rabbits with drugs have been variously reported by many workers (Quintela et al. 2003, Adams (1981), Theaus-Clement and Roustan (1992). This confirms the report that in rabbits, ovulation does not occur spontaneously, but it has to be induced through neuro-hormonal reflex. This can be done through naturally or (normal mating; better results comes from mating frequency) and artificially through the use of drugs

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