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The Effect of Natural Breeding Partern on the Reproductive Efficiency of New Zealand White Rabbit Does in the Humid Tropics

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Abstract: ***The study was to determine the influence of natural mating pattern on the reproductive parameters of rabbits does. Twenty seven (27) adult post pubertal fertile does and nine (9) 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 Group A = Morning artificial mating only; Treatment Group B = Morning and afternoon artificial mating; Treatment Group C = Morning, afternoon and evening artificial mating. The results showed positive significant different (P < 0.05) on the conception rates and litter size amongst the treatment groups as the frequency of mating increases. Treatment C (morning, afternoon and evening mattings) was significantly higher (77.78) than treatment B (i.e. morning and evening mating) and A (morning mattings). The trend was the same for litter size. Group C was significantly higher (P < 0.05) than B and A that is 7.62, 5.88 and 4.63 respectively for the litter size, while group B and C are not significant. Litter weight of the kids where significantly affected progressively as the mating frequency decreases (P < 0.05). Gestation length did not show any significant response (P > 0.05) between the treatment groups which are A (30.5), B (29.67) and C (30.68) respectively. The mortality of the doe was recorded in treatments. B, and non in groups A and C. Kids mortality was not significantly affected (P > 0.05). One doe exhibited pseudo pregnancy in group A, non in B and C. No case of abortion was recorded in all the groups. It was therefore concluded of natural mating pattern can enhance reproductive efficiency in rabbit husbandry especially in the humid tropics of West Africa.***

Keywords: Rabbits, Breeding Pattern, Reproductive efficiency, Humid Tropics

1. Introduction

The low animal protein intake in several developing countries particularly Nigeria has been claimed partly on over-population and partly on over-reliance on large-size but slow growing farm species, prolonged production cycles (Ibeawuchi and Fajuyitan, 1986). There is therefore the need to gradually shift emphasis from these large capital intensive species to those with relatively low feed/input cost and short production cycles such as the rabbit. Apart from its well reputed prolificacy, the rabbit has several other advantages over many other farm species including its high quality meat with higher protein and much lower fat cholesterol contents (Fielding, 1991).

Inspite of these advantages large scale rabbit production has been hesitant and somewhat hampered in Nigeria and several other less developed countries, because of dearth of relevant information on the rabbit's complex sexual behaviour (no well defined cyclic oestrus) and the attendant problem of controlled mating.

Reproduction is a biological phenomenon which occurs in all living organisms. Essential to the propagation of the animal species is the maintenance of the integrity of the gametes from the time of its genesis until syngamy so as to support normal embryo genesis and subsequent development (Umesiobie et al., 2001), Dalton (1987) stated that the significance of reproduction is the perpetuation of the species and prevention of its extinction. Rabbit's sexual behavior and breeding potential are all influenced by a wide range of external and internal stimuli (Berepubo and Umanash, 1995, Ajuogu, 2002).

The female rabbits are 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). They do not have estrus (heat) cycle with regular periods of heat (estrus), as do other small animals like dogs and cats. In fact, adult female rabbits are considered to be more or less always in estrus and are "reflex ovulators". This means that ovulation is induced only after coital stimulation and happens automatically 9 – 13 hours after copulation act.This biological feature seems to presuppose that non-pregnant female rabbits would accept her male counterpart for mating at every presentation and indeed conceive at each mating since it is an induced ovulator (Berepubo, et al. 1993).

Rabbit's onset of puberty depends on breeds. Rabbit will reach sexual maturity somewhere, between the age of 4 – 5 months in the female and 5 – 8 months in the male. Does tend to be slightly larger than the bucks, but bucks have broader heads; does tend to be more territorial than bucks and so the doe should be taken to the buck or to neutral territory for breeding to avoid aggression. When intact both male and female rabbits usually mount one another endlessly out of sex drive and on to stylish social dominance (Dan Krampels, 1998).
Although not all rabbits exhibit objectionable behaviors upon reaching sexual maturity, many (if not most) do. One can expect to see the following behaviors once these sex hormones kick in:

Also, Dan Krampels (1998) reported that upon reaching sexual maturity, male rabbits often begin displaying mounting behavior, making territory with urine and producing a musky sex odour. Male rabbits can be very aggressive when the testosterone kicks in. Rabbits are reflex ovulators. There's no definite oestrus cycle, but periods of receptivity usually occur for 12 – 14 days, followed by 2 – 4 days of non-receptivity while new follicles, are developing. However this can be highly variable, and some does will become receptive every 4 – 6 days during the breeding season (January to September). When receptive, a doe will become very active, rub her chin on objects and exhibit lordosis, and the vulva becomes congested and reddish purple sexually mature bucks will mate at any time. Courtship behavior is very brief (approximately 30 seconds) and involves sniffing, licking and following the doe.

Enurination, the spraying a of urine at the doe, is common sexual behavior (Japson and Meredith, 2003). Copulation is very brief and involves a vigorous thrusting intromission, which often leads to the buck falling backward or sideways and vocalizing. Ovulation occurs ten hours after copulation. Does may also mount each other, and this or an infertile mating can induce ovulation and lead to a psuedo-pregnancy, which last approximately 18 days.

In most domestic mammals ovulation takes place at regular intervals when the female is in heat or estrus. The interval between two periods of estruos represents the length of the oestrus cycle (four days for rats, 17 for ewes, 21 for sows and cow). Ovarian activity in the rabbits and cat is dependent on photoperiod. The rabbit is polyestrus and also an induced ovulator (Shille et al, 1979). Oestrus in free ranging females is induced by an increase in day length, whereas decreasing photoperiod results in seasonal anoestrus (Berepubo,*et al.*, 1993). However, high ambient temperatures during summer may reduce the incidence of oestrus (Concannon and Lein, 1983; Feldman and Nelson, 1996). It is possible to induce oestrus by social stimuli by an oestrus female (Michel, 1993).

Factors controlling growth of ovarian follicles and selection of those that will ovulate is not completely understood. Follicular development to the antral stage may occur independent of gonadotrophin action, but the rate of pre-antral follicle growth is accelerated by gonadotrophins. Number and size of follicles on ovaries collected at various days of the estrus cycle have been reported for cows (Rajakoski, 1960), and rabbits (Fielding, 1991). One factor emerges from these studies i.e. follicles of all sizes including large follicles, exist on each day of the oestrus cycle.

Furthermore, it is clear that sequence of follicular growth regress and are replaced by other large follicles during the cycle (Matton, *et al.*, 1981). For example, Matton *et al.* (1981) marked large follicles with Indian ink in heifers, and reported that most of the largest and second largest follicles present on the ovaries on day 3 regressed and were replaced by other follicles by day 8. In addition, half of all the largest follicles present on day 8 were no longer the largest by day 13 and all the follicle present on day 13 were replaced at about day 18. The large follicles that eventually ovulate are identifiable on the ovary only 48 hours before oestrus (Dufour et al, 1972).

Following Luteal regression, both estrogen active and estrogen inactive follicles are present on ovaries. By the time of LH surge, only estrogen active follicles are present. Ovulatory follicles grow in size and the number of LH receptors in the theca and granulose increases. As a result, these follicles become more responsive to LH and acquire an increased ability to secrete estrodiol. In contrast, number of FSH receptors decrease in ovulatory follicles relative to those present earlier. Apparently, the pre-ovulating gonadotropin surge converts estrogen active follicles to estrogen-inactive ones; i.e. following the surge but before ovulation. Content and number of LH receptors in the theca and granulose decrease.

2. Materials and Methods

Twenty seven (27) adult post pubertal fertile does and nine (9) fertile bulks with an average weight of 2.8kg were randomly assigned to three (3) experimental groups in a Completely Raondomized experimental design (CRD) as follows: The females were further replicated three with three rabbit's per-replicate while the males were replicated twice. The treatments were properly tagged for easy identifications indicating the breeding pattern and timing illustrated thus;

A=Morning mating 8-9am, (once mating per day) (control)
B=Morning mating 8-9am, afternoon mating 1-2pm (twice mating per day)
C =Morning mating 8-9am, afternoon mating 1-2pm and evening mating 7- 8am (thrice mating per day).
D=Artificial mating (i.e insemination by artificial or mechanical means)

The females were taken to the males for service and returned thereafter. The males belonging to each treatment group were used to serve the females in that group. Groups A-C females were naturally mated with males in their various groups while group D females were artificially inseminated by the semen collected from the male of that group.

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). Each doe was weighed before mating with the aid of weighing balance to know the initial weight and weekly after mating until kindling. Variables used to measure reproductive parameters were conception rate, gestation length, litter size, lifter weight, pseudo-pregnancy, weaning weight and mortality. Two parities were obtained. Data on reproductive parameters were collected and subjected to analysis of variance according to Steel and Torrie (1981) and their means separated by Duncan multiple range tests by Duncan (1955).

3. Results

Table 1: Influence of Natural mating frequency on Reproductive Parameters

Reproductive Parameters	Treatments		
	A	B	C
Conception rate (%)	33.5^c ± 2.56	44.4^b ± 4.60	77.78^a ± 6.50
Gestation length (days)	30.5 ± 1.00	29.67 ± 0.05	30.68 ± 0.00
Litter size	4.63^b ± 0.03	5.88^b ± 0.54	7.62^a ± 0.06
Litter weight (g)	42.34^a ± 2.46	39.41^b ± 31.2	36.33^b ± 3.64
Doe mortality	0.00 ± 0.00	1.00 ± 0.00	0.00 ± 0.00
Kid mortality	1.0 ± 0.00	3.00 ± 0.00	4.00 ± 0.00
Pseudo pregnancy	1.0 ± 0.00	0.0 ± 0.00	1.00 ± 0.00
Abortion	1.0 ± 0.00	0.00 ± 0.00	0.00 ± 0.00

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

The results showed positive significant different (P < 0.05) on the conception rates and litter size amongst the treatment groups as the frequency of mating increases. Treatment C (morning, afternoon and evening mattings) was significantly higher (77.78) than treatment B (i.e. morning and evening mating) and A (morning matings) i.e. 44.46 at 33.5 for B and C respectively for conception rate. The trend was the same for litter size. Group C was significantly higher (P < 0.05) than B and A that is 7.62, 5.88 and 4.63 respectively for the litter size, while group B and C are not significant [amongst themselves] a difference (P > 0.05) among the groups.

Litter weight of the kids where significantly affected progressively as the mating frequency decreases (P < 0.05). The highest weight was recorded in treatment group A (42.34) than group B (39.41) and C (39.41) respectively.

Gestation length did not show any significant response (P > 0.05) between the treatment groups which are A (30.5), B (29.67) and C (30.68) respectively.

The mortality of the doe was recorded in treatments. B, and non in groups A and C. Kids mortality was not significantly affected (P > 0.05). The values are 1, 3 and 4 for treatments A, B, and C respectively. One doe exhibited pseudo pregnancy in group A, non in B and C. No case of abortion was recorded in all the groups.

4. Discussion

The results of the influence of natural mating on conception rate and litter size which showed significant positive (P < 0.05) response as the natural mating frequency increases, suggests that mating frequency in rabbits improves reproductive efficiency (conception rate and liter size). This corroborate the earlier workers Ajuogu et al. 2009; Paufler (1985). They said that frequency of mating either natural or artificial (Ajuogu and Ajayi, 2010) improves some reproductive parameters (conception rate, litter size and kindly rate). This means that the more the number of mating, the greater the tendency of conception, and likelihood of more litters. This reaffirmed the fact that rabbits are induced ovulators. In rabbits, ovulation does not occur spontaneously like other farm species as sheep, goat, and cattle but, it has to be induced through mating (Hafe, 1993). Therefore, the more the neuro-hormonal reflex from increased mattings, the more induction of ovulation and the release of more egg or ova which will ultimately be fertilized by the viable spermatozoa discharged by the males through natural mattings. The low conception and litter size in treatment A (once mating), maybe related to insufficient physiological stimulation or neuro-hormonal reflex which led to low or no conception amongst the animals in that groups (Murdoch and Dunn, 1982). This will imply that the endocrinal gland could not receive enough stimulus (signal for concomitant release of ovulation hormones e.g. LH and FSH (Murdoch and Dunn, 1982). Robinson and Sawyer, (1987) reported that a control stimulus induces a neural reflex that stimulate the medial basal hypo-thealamus to synthesize and liberate gonadotrophin- releasing hormones (GnRn), which then stimulates the release of pituitary luteinizing hormones (LH). Adequate LH surge also depends on the number and frequency of copulation. LH release occurs rapidly with increase in serum concentrations evident within 16min after mating (Johnson and Gay, 1981) and remain elevated until 8 – 12 hours in ovulating rabbits, whereas the LH levels remain low in the rabbits that do not ovulate (Concannon et al. 1980). They further reported that multiple copulation regimens such as four copulation during a 21 – 81 mins period or adlibitum copulatory activity for 4 hours (8 – 12 copulations) results in 100% successful ovulation.

Also, litter size of the rabbits in natural mating factors, are within the ranges recommended by Paufler (1985) who states that the average litter size of rabbits are within 7 – 8 for heavy breeds. Brawer (1992) reported 1 – 20 young per litter. Also Paufler (1985) reported reduced litter size in does mated immediately after handling. The result of increased litter as the mating frequency increases suggest that mating frequency increases the number of eggs ready to be fertilized which ultimately will result to increased litter size. This corroborates the reports of Tilton and Cole (1982) who revealed an increase in the number of piglets at birth with increased number of mating. Ajuogu et al. (2009) similarly reported an increase in litter size with increase in frequency of mating.

The gestation length which averaged 30 days in this study (Natural mating frequency) are within the range recommended by Paufler (1985), and Fielding (1991) which is between 30 – 20 days. They reported that gestation depends upon well functional corporal lutea. From this study, the results proved mating frequency (Natural mating frequency) has no influenced on the gestation length of the rabbits. This is in line with what Ajuogu (2002) reported that mating frequency both artificial and natural has no effect of the length of the gestation in rabbits.

The litter weight which was negatively affected by the natural mating frequency suggest that probably the more the conception the higher the litter size and litter size on the other hand has a negative relationship with litter weight. This means that the more the number of litters, the smaller their weight. Ajuogu and Okejim (2010) reported negative correlation between the litter size and litter weight Paufler (1985) reported reduced litter size in does mated immediately after kindling reported having average of 65gm at birth.

Pseudo pregnancy was not affected by mating frequency in this study. Pseudo pregnancy in rabbits occurs or happens if ovulated oocytes are not fertilized or pregnancy fails, female's rabbits (doe) undergoes a short luteal phase or pseudo pregnancy and this last half of the gestation period (15 days) Feldman and Nelson 1996).

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