

Research paper**RESPONSE OF NATURAL MATING FREQUENCY AND
ARTIFICIAL INSEMINATION ON FERTILITY IN RABBITS AND
THEIR CYTO-GENETIC PROFILE (X-CHROMATIN)****ABSTRACT**

A study was conducted to determine the Cyto-genetic profile of breeding rabbits and the impact of natural mating frequency and artificial insemination on its fertility. Twenty four (post-pubertal) does aged 8-9 months and four matured (aged 10-12 months) fertile bucks of New Zealand white breed, were randomly assigned to four treatment groups designated A, B, C and D respectively in Completely Randomized Design (CRD). Treatment A-C indicated increasing levels of daily mating of once a day (treatment A-the control), twice daily (treatment B) and thrice daily (treatment C) mating pattern. Treatment D was subjected to artificial matting pattern. The experiment lasted for six months, during which two parities were obtained. The mean conception rate, kindling rate and litter size differed highly significantly ($P<0.001$) among the treatment groups according to increasing levels of frequency of daily mating. Significant differences ($P<0.05$) were also observed on litter weight, by decreasing order of daily matting frequencies. No statistical difference ($P>0.05$) was seen on gestation length. The X-chromatin incidence of does with zero conception and their males were within a normal range of 2-12% and 0-2% respectively. It was concluded therefore that daily mating frequency has a favorable influence on reproductive parameters examined in this study.

Keyword: Breeding, Rabbit Doe Artificial vagina, Pseudo-pregnancy, Post Pubertal, Teaser Doe

INTRODUCTION

34 Reproduction is a complex biological phenomenon which occurs in all living organisms.
35 Its significance and manipulations are the secret tools for the improvement of animal
36 fertility (Berepubo *et al.* 1993; Dalton 1987).

37 Rabbit's sexual behavior and breeding potential are all influenced by a wide
38 range of external and internal stimuli (Berepubo and Umanah, 1995; Ajuogu and
39 Ajayi 2010).

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41 The female rabbits are reputed to have complex and peculiar reproductive pattern. Apart
42 from having high incidence of pseudo-pregnancy, the female rabbits are also considered
43 poly-oestrous, or as having no cyclic or regular estrus (Berepubo *et al.*, 1993, Ajuogu and
44 Ajayi 2010). These biological features seems to presuppose that the non-pregnant female
45 rabbits would accept her male counterpart for mating at every presentation and indeed
46 conceive at each mating since it is an induced ovulator. Berepubo *et al.*(1993) ; Fielding
47 (1991) reported that other estrous signs in female rabbits even though less visible, than
48 other farm species undergoes a rhythmic weekly (5-7days) estrous cycle. Influence of
49 mating frequency is important in the reproductive performance of farm animals including
50 rabbits (Ajuogu 2002; Ajuogu and Ajayi (2010). Pitkajenen (1955) reported a 0.285
51 increase in ovulation rates of the mated groups of sows. Reed (1985) compared fertile
52 results of sows inseminated three times in each estrous period with those of sows
53 inseminated twice. He reported both an increased conception rate and an increased litter
54 size. Randel *et al.* (1973) reported that clitoral stimulation following artificial
55 insemination of beef cows hastened the onset of ovulation with cervical stimulation
56 reducing the time from the beginning of estrous to the luteinizing hormone (LH) surge

suggesting that a neutral path way may exist between the genital system and the hypothalamic pituitary axis.

MATERIALS AND METHODS

Twenty four Post Pubertal female rabbits aged 8-9 months and four mature fertile bucks aged 10-12months of New Zealand white breeds were randomly assigned to four treatment groups A,B,C and D in a Completely Randomized Experimental design (CRD). The females were further replicated twice with three rabbit's per-replicate. 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)

A reinforced polyvinylchloride (PVC) tube (inner diameter 2.8cm, outer diameter 3.8cm) was cut to a length of 3.0cm and referred to as the lager tube (LT). A rigid plumbing hose (inner diameter 1.7cm outer diameter 2.7cm) was also cut to the same length and called the smaller tube (ST). These were use to construct artificial vagina according to (Herbert and Adejumo, 1996)

The artificial vagina (AV) unit was warmed by putting it in warm water at 60°C for 10-15 minutes in a rubber container according to Herbert and Adejumo (1996). A mature non gravid doe was used as the teaser animal. As the buck mounts and makes a thrust on the teaser doe, the pre-warmed AV was quickly applied from side of the erect penis of the buck prior to intromission of the penis on the AV, which elicited ejaculation within a few seconds. The semen volume (in ml) was read directly from the collection tube and used for the insemination.

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.

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, litter 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 test by Duncan (1955).

RESULTS AND DISCUSSION

The results of the effect of mating frequency and artificial insemination on reproductive parameters in parity one and two, are summarized in table 1. The result showed that conception rate was significantly influenced ($P<0.05$) by natural mating frequency in parity 1 and 2 than the artificial mating group. In parity one, treatments C and D recorded the highest and the least conception rate of 83.3% and 16.7% respectively (table 1) while in parity two, the highest and lowest conceptions rates were in treatments C and A (I.e. 100% and 33.3%). The average gestation length had no significant ($P<0.05$) effect between the treatment groups on both parties. Average kindling rate showed significant increase ($P<0.05$) except in artificially inseminated group i.e. 33.3%, 66.7%, 91.65% and 8.38% for treatments A, B, C, and D respectively. Also, the results of the average litter size and lifter weight showed significant difference amongst the treatment groups ($P<0.05$) for litter size. It progressively increased according to the mating frequency in both parities (3, 0, 4.67, 5.8, 4.0) (3.0, 4.25, 6.17, 0.0) for treatments A, B, C, and D for parities 1 and 2 respectively. But the effects on the litter weight were negatively affected by the mating pattern i.e. the higher the frequency of mating, the lower the litter weight. Pseudo-pregnancies were also observed among the treatment groups in both parities. The highest was recorded in treatment D in both parities. Mortality of does and kids were also observed.

The results of X-chromatin (drumstick) incidence are presented in table 2, The average drumstick incidence of the females evaluated was 4.447%, while the average % X-chromatin (drumstick) incidence of the males was 0.00%. The X-chromatin incidence in one of the females (F6) in treatment A was 0.00%.

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126 Fairly high conception rates ranging from 33.3-100% were observed with the increasing
127 frequency of mating in this study. This finding supports that of Paufler (1985) who
128 reported increased reproductive performance, conception rates and litter size of rabbits
129 inseminated more than once.

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131 However, this group recorded the least conception rate of 16.7% during the first parity
132 and 0% during the second parity. This observation may be related to the insufficient
133 physiological stimulation of the females (Murdoch and Dunn, 1982), Fielding (1991)
134 resulting in low conception rate or non- conception. This supports the assertion of these
135 workers; Berepubo *et al.*(1993); Paufler (1983) that rabbits are induced ovulators. This
136 implies that endocrinal gland could not receive enough stimuli (signal for concomitant
137 release of ovulation hormone; Leutenizing hormone and Follicle stimulating hormone
138 (Murdoch and Dunn 1982) for induction of ovulation, it is possible therefore, that the
139 ovum or ova were not released for fertilization by the semen introduced through artificial
140 insemination, hence the poor or no conception observed. Also Ajuogu and Ajayi,
141 (2010) reported that frequency of mating either natural or artificial to improves
142 some reproductive parameters (conception rate, litter size and kindly rate).
143 However, the reports of Paufler (1985); Fielding (1991) and Berepubo *et al.* (1993)
144 revealed that rabbits undergo a rhythmic weekly (5-7 days) oestrus cycle. This may be
145 the reason for 16.7% conception rate recorded in treatment D among the artificially bred
146 does. The insemination may have been co-incidental on their oestrus period since there
147 was no tactile or physiological stimulation. The 0.0% conception rate of the same does in

group D in the second parity seems confirmatory to this assertion. Rahajo *et al.* (1986) similarly observed poor conception rates in artificially inseminated rabbits. He implicated lack of induction of ovulation as being responsible.

The result of no significant influence ($P < 0.05$) on gestation length, suggest that mating frequency and artificial insemination had no effect on gestation length. This corroborate Omole and Sonaiye (1991); Aduko and Olukosi (1990) who reported a mean gestation length of 31.6days in a well managed rabbit breeding outfit. The result of the kindling rate with significant influence ($P < 0.05$) from the treatment (natural mating frequency) agrees with the assertion of Drugociu (1996) who implicated vaginal uterine Stimuli (tactile Stimulation through coitus) resulting in higher conception rate, kindling rate and greeter viability in-utero.

Also litter size which showed significant difference ($P < 0.05$) among the groups (mating frequency and artificial insemination) with the highest values recorded in treatment B) (5,4) and C (6,6) could probably be due to increase in neural and endocrinal release of Leutenizing hormone and Follicle stimulating hormone during copulation, which act on ovary causing more release of ova. This supports Check *et al.* (1987) who observed that copulation in rabbits stimulate the immediate release of Leutenizing hormone with peak serum levels reached in 1-2hours post copulation. This implies that the more the number of eggs released due to coital stimulation, the more the available sperm cells in the reproductive system will fertilize them. This will by and large affect the number of litters and other parameters (Conception rate, litter size and kindling rates).

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172 The mean percent drumstick incidence obtained from animals in treatments A, B C and
 173 D, that had zero conception ranged from 2.5 to 15.0% with a mean value of 4.5%. This
 174 observation agrees with that of Basrur, (1984) who documented that some mammals such
 175 as humans and cattle showed an X-chromatin incidence of 2% - 12% in a normal female.
 176 Also Davidson and Smith (1954) reported an X-chromatin incidence of 0.5% per
 177 200pmn. These observations therefore suggests that the females in treatments D (F1 -5),
 178 A (F6-9) and B (F10-11), that had zero conception (Table 2) may not have been affected
 179 by any form of health or management problems. According to this study, the treatment
 180 effect (artificial insemination and natural mating frequency) was implicated in the
 181 observed variations. Therefore, it could be implied that the influence of mating once,
 182 (treatment A) twice (treatment B) and artificial mating without artificial induction
 183 (treatment D) may have been the possible cause of zero conception observed within the
 184 groups in reference. Nevertheless, the zero percent (0.0%) X-chromatin (drumstick)'
 185 incidence of one of the females in treatment A (F6) may be suggestive of a fundamental
 186 genetic (sex-chrormosomal) disorder with the consequence of reproductive failure (Long
 187 and Williams, 1 980;Hare, *et al.*, 1980; Bhatia and Shanka, 1982; Berepubo, *et al.*, 1993;
 188 Wekhe, 1998)..

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190 Furthermore, the X-chromation of the males (ml-3) had (0.0% drumstick) was in line
 191 with Basrur (1984) who reported an X-chromatin appendages of 0.0% -2.0% for normal
 192 mammalian males. The above observation therefore, suggest that genetic reproductive

abnormalities may not have contributed in the observed differences in reproductive and productive performances

CONCLUSION

It was demonstrated that increased natural mating frequency has better influence on reproductive parameters (Conception rate, litter size and kindling rate) than artificial mating pattern in rabbits.

Pseudo-pregnancy; one of the major constraints in effective reproduction in rabbits, can be reduced greatly by increasing frequency of natural mating.

The influence of artificial insemination on reproductive performance of rabbits may be enhanced when the doe in question are properly induced physiologically (tactile induction) (Paufler 1985).

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277 **Table 1: Reproductive performance of does in the first and second parity**

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Reproductive	Parity 1				Parity 2			
Parameters	<u>Experimental groups (mean +SEM)</u>				<u>Experimental groups (mean +SEM)</u>			
	A	B	C	D	A	B	C	D
Av. Concept.rate(%)	33.3±0.0 ^c	66.7±0 ^a	83.3 ±0 ^a	16.71±0.0 ^d	33.3±0.0 ^c	66.7±0 ^b	100.0±0 ^a	-
Av. Gest. Length(days)	30.5±1.0	31.3±0.0	30.6±00	1.0±0.0	31.5±16	31±1.0	31.0± 0	-
Av. kindling rate (%)	33.3±0.0 ^a	66.7±0.0 ^d	91.65±1.0 ^c	8.38±0.0 ^d	-	-	-	-

Average litter size (Number)	3.00±0.0 ^a	4.67±1.0 ^c	5.8±1.0 ^c	4.00±0.0 ^b	3.0±1.0 ^a	4.25±0.0 ^{ab}	6.17±0.0 ^c	-
Av. litter weight(g)	85.20±1.9 ^a	72.80±2.4 ^b	68.00±2.4 ^b	5.70±0.0 ^{ab}	81.7±57 ^a	71.28±31 ^{ab}	67.35±2.3 ^{b-}	-
No of pseudo-pregnence	2	2	0	-	-	-	3	-
No of still births		--	-	-	-	-	-	-

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282 **Table 2 X-chromatin status of the animals used for Breeding**

283 Animals No of Neutrophils % incidence of Drumstick

284 A1 200 3.6

285 A2 200 6.67

286 A3 200 15.4

287 A4 200 2.04

288 B5 200 2.04

289 B6 200 0.00

290 B7 200 4.17

291 F8 200 7.14

292 F9 200 4.55

293 F10 200 5.13

294 F11 200 2.5

295 F1 200 0.00

296 F2 200 0.00

297 F3 200 0.00

298 Mean 200 4.44

