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Fertility factors in lactating rabbits mated 24 hours and 25 days after parturition

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Summary. Fertility is compared in lactating rabbits mated 12-18 hours postpartum and 24 days postpartum. The lower fertility in the former group is the result of lower ovulation rate and a larger number of oocytes remaining unfertilized. 11.1 oocytes are shed in the early mated lot, while 14.0 are shed in the other group. 23 p. 100 of the oocytes remain unfertilized in the first group, while 5 p. 100 are unfertilized in the second. These differences are significant. However, there is no difference in embryonic mortality before or after implantation and corpus luteum weight does not differ significantly in the two groups. Under constant daylight ratio (16 L × 8 D) no fertility change during the year is noted in either group.

Introduction.

Intensification of rabbit production demands shortening the interval between two successive pregnancies (Prud'hon *et al.*, 1969) ; the technique of weaning the young early (Prud'hon and Bel, 1968) facilitates this requirement.

The early research of Hammond and Marshall (1925) showed that the success of pregnancy during lactation could be improved by reducing the number of young suckling and by providing an unlimited food supply. Adams confirmed these results in 1967.

In *ad libitum* feeding conditions, mating during postpartum estrus seems to induce only a low ovulation rate (Harned and Casida, 1969). This rate increases when the interval after parturition lengthens (Harned and Casida, 1969), but the number of females receptive to the male between 1 and 5 days is low (Harned and Casida, 1969). The percentage of females in estrus and of females ovulating as well as ovulation rate only become normal at about 10 days (Prud'hon *et al.*, 1969).

Finally, seasonal variations in fertility may increase postpartum subfertility (Bradburry, 1944).

In this report we study the fertility factors affected when mating occurs 24 hours after parturition ; primiparous females mated 25 days after parturition are used as controls.

Material and methods.

One hundred and forty California primiparous rabbits were raised under 16 h daylight/8 h darkness at a temperature not lower than 15 °C.

The males were raised under the same daylight ratio and temperature.

— 40 lactating rabbits were mated 25 days after parturition (lot 1),

— 100 lactating rabbits were mated 12 to 18 hours after parturition (lot 2).

The same concentrated feed was given *ad libitum*.

Results were regrouped according to 3 seasons :

— september to december (season 3) is considered as the low fertility period in the wild rabbit,

— january to march (season 1) and,

— april to july (season 2) as periods of good fertility.

Rabbits in both lots were uniformly distributed among these three seasons.

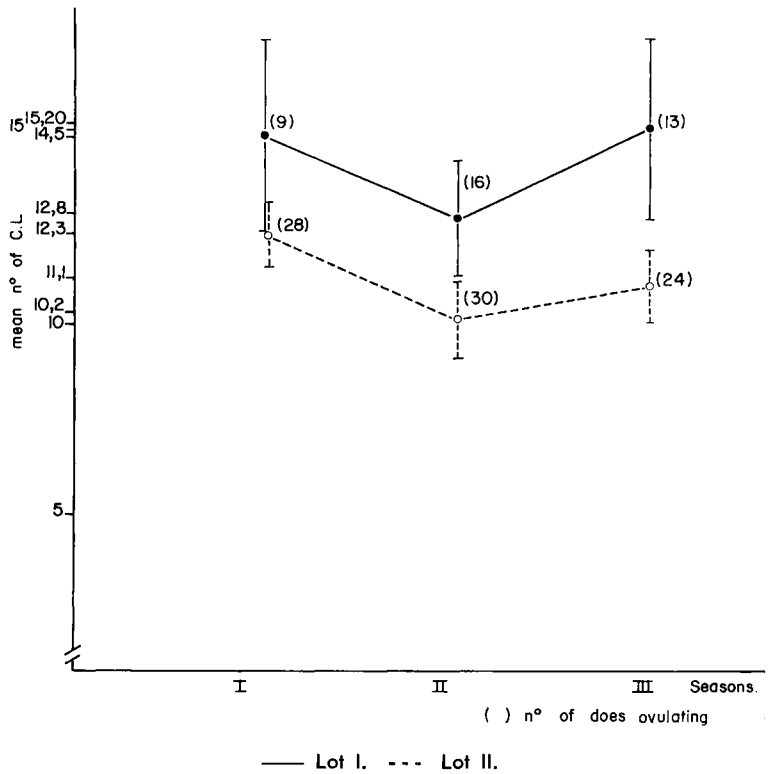

FIG. 1. — *Mean number of corpora lutea in the two lots during the three seasons.*

To localize the causes of low prolificacy the rabbits were slaughtered :

a) thirteen and 24 hours after mating to study the percentage of eggs penetrated by spermatozoa, the evolution of male and female pronuclei and the beginning of segmentation,

b) six and one-half days after mating to observe the stage of blastocyst development and the mortality rate before implantation,

c) eleven days after mating to study mortality after implantation.

Results.

The use of a constant daylight ratio (16 L × 8 D) all year long and a stable temperature annuls seasonal variation of ovulation rate and receptivity to the male. There is no significant difference between seasons in the percentage of rabbits ovulating and the mean number of corpora lutea per rabbit. On the other hand, there is a significant difference between the two lots for each season used (fig. 1). Thus, results for the whole year are regrouped without taking account of the seasons and the mean number of ovulation is 14,0 for lot 1 and 11,1 for lot 2.

Fertilization rate and beginning of development in postpartum rabbits.

When rabbits are mated 12-18 hours after parturition, about 2 hours after ovulation (13 hours after mating), 2.3 ovocytes generally remain unfertilized out of the 9.7 recovered by flushing the tubes (table 1) ; this represents a total of 23 p. 100 unfertilized eggs. Twelve hours later the percentage is somewhat different : 1.6 unfertilized eggs out of the 10.4 recovered, or 15.7 p. 100.

TABLEAU 1

Number of eggs ovulated and unfertilized 13 hours and 24 hours after mating

	Lot	Number of rabbits	Mean number of egg/doe m ± SE (m)	Mean number of unfertilized eggs m ± SE (m)	Number of eggs	Number of unfertilized eggs	p. 100 unfertilized eggs
13 h	1	13	9,3 ± 1,7	0,5 ± 0,3	121	6	5
	2	15	9,7 ± 0,7	2,3 ± 0,8	146	34	23
24 h	1	22	10,4 ± 0,6	1,6 ± 0,7	229	36	15,7

This proportion is higher than observed in rabbits mated 25 days post partum : either about 13 hours after mating (0.5 ovocytes unfertilized out of 9.3 recovered) or 22 to 25 hours after mating when all eggs recovered were fertilized. Thus, the

number of eggs fertilized is lower when mating occurs 24 hours after parturition which contributes to reduced fertility.

On the other hand, the development of the pronuclei is not hardly different. 2-blastomere stage is reached after the same elapse of time (table 2). This indicates that there is no delay in the time of ovulation or of fertilization.

TABLEAU 2

Stages of pronuclear formation (according Thibault, 1967) and cleavage 13 and 24 hours after mating in lactating rabbits mated post partum (2) or 25 days later (1)

Lot		Pronuclear stages					Cleavage	
		1	2	3	4	5	2 cell.	4 cell.
1	No	24	84	37	7			
	p. 100	16	55	24	5	0	20	0
2	No	3	44	41	29			
	p. 100	3	37	35	25	7	183	3

Developement of blastocyst. Mortality before implantation.

In rabbit slaughtered 6 1/2 days after mating, the mean percentage of blastocysts recovered as compared to the number of corpora lutea shows no significant difference between lots nor seasonal influence. However, the is large variability (fig. 2) ; in lot 2 it is significantly higher than in lot 1. Embryonic mortality before implantation is thus not higher in lactating rabbits mated within 24 hours postpartum.

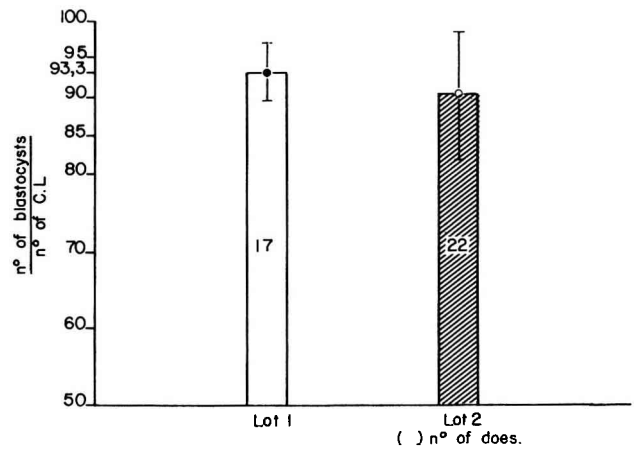

FIG. 2. — p. 100. *Blastocysts recovered at 6 1/2 days.*

The sizes of blastocysts are not significantly different in lots 1 and 2, however in lot 2 they could be larger (fig. 3). At the same time, we found no significant difference in corpora lutea weights between the two lots.

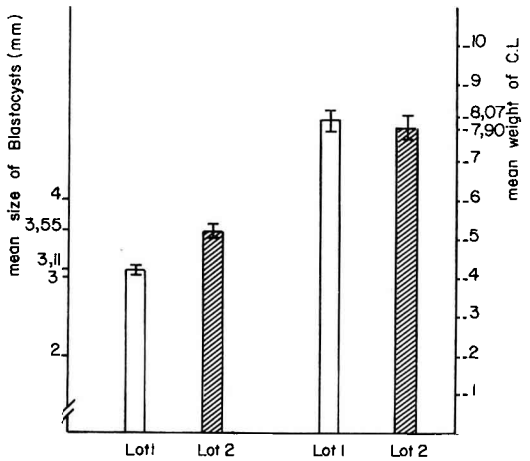

FIG. 3. — *Mean size of blastocysts and corresponding mean weight (g) of corpora lutea in the two lots of lactating rabbits.*

Embryonic mortality after implantation.

We compared embryonic survival after implantation at day 11 of pregnancy to that at 6 1/2 days postpartum. We found a period of high mortality at 8-9 days detected by dissection of the uterus at 11 days showing traces of the decidual reaction

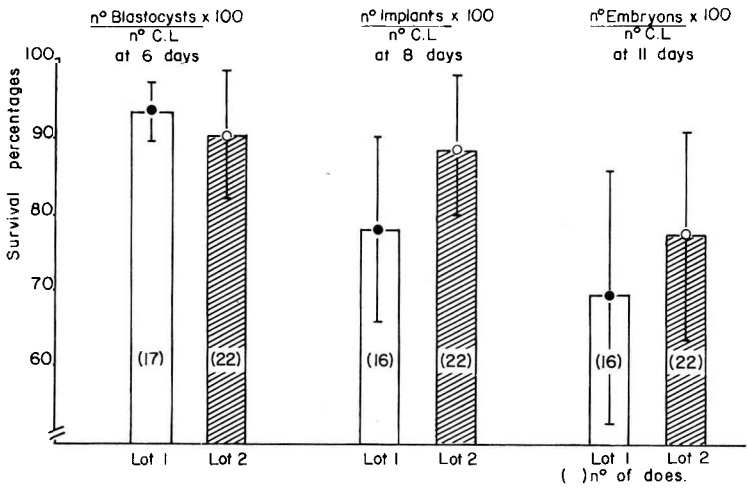

FIG. 4. — *Comparative embryonic survival in the two lots.*

which remained after the fetus had degenerated. Figure 4 shows the results of embryonic survival recorded at three successive stages ; those of 8 and 11 days are computed on the same rabbits.

In lot 1 embryonic survival decreases regularly between 6 and 11 days ; the same results are obtained in lot 2. Differences between the two lots are insignificant at all levels.

The only fact which appears clearly in this study is the decreased number of ovu-

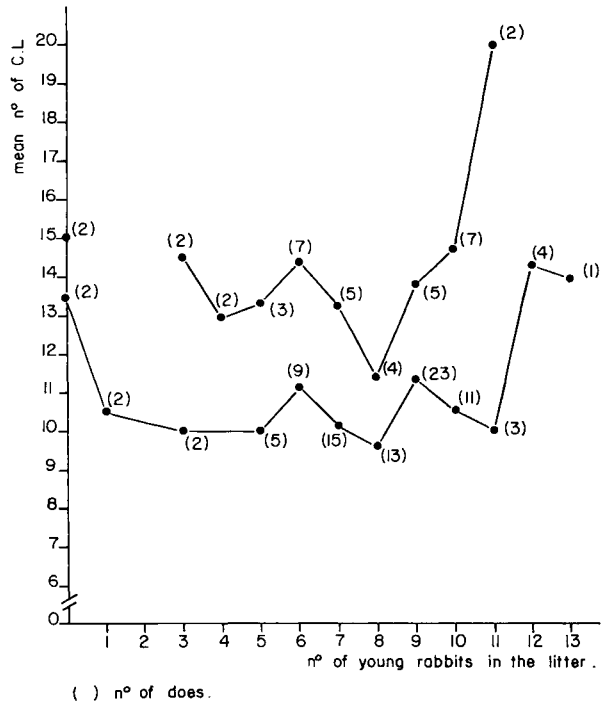

FIG. 5. — *Relation between mean number of corpora lutea post partum and the mean number of young rabbit at last litter.*

lations in lactating rabbits (lot 2). We have attempted to show a relation between the size of the preceding litter and the number of postpartum ovulations. Figure 5 shows no negative or positive correlation between the two factors.

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Résumé. La fertilité des lapines lactantes est comparée suivant qu'elles sont accouplées 12 à 18 h après le part ou 25 jours après. La diminution de la fertilité dans le 1er groupe est dû à un taux d'ovulation inférieur et à un plus grand nombre d'ovocytes non fécondés. En moyenne, 11,1 ovocytes sont pondus dans le 1er groupe (12-18 h) contre 14,0 dans le 2e groupe (25 jours). 23 p. 100 des ovocytes ne sont pas fécondés dans le 1er groupe contre 5 p. 100 dans le 2e. La différence est significative. On ne constate pas de différence entre les

deux groupes en ce qui concerne la mortalité embryonnaire avant et après implantation, le poids des corps jaunes ne diffère pas significativement dans les deux groupes. Sous des conditions d'éclairement constant pendant toute l'année (16 L × 8 D), on n'observe pas de changement de fertilité pendant l'année quel que soit le groupe considéré.

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