TERMINATION OF PREGNANCY AFTER ACCELERATED LACTATION IN THE RAT

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(Received 26th March 1971)

The gestation period in rats that have bred during a *post-partum* oestrus is known to be lengthened if the female is suckling a moderately large litter. Presumably, this lengthening is due to a prolongation of the progestational period and the embryos may remain dormant in the blastocyst stage for up to 14 days (Weichert, 1940; Psychoyos, 1970).

We wanted to determine whether heavy lactation might also induce dormancy in postimplantation embryos or if other effects might take precedence, for example, if the mother would continue to suckle the large litter or if the pregnancy would be terminated.

Holtzman strain rats were used throughout the experiment. Pregnant females were caged with experienced males at least 8 days before parturition. *Post-partum* mating was checked by vaginal smears and the males removed from the cages thereafter. The day on which spermatozoa were found in the smear was designated Day 0. At parturition, the litters were reduced to two or three young; normally, this number will not delay implantation, but will maintain milk secretion (King, 1913; Weichert, 1940). Females were permitted to nurse these few young until Day 9, when laparotomies under semi-sterile conditions, using ether anaesthesia and mid-ventral incisions, were performed to confirm implantation. The animals with implanted embryos were then given from eleven to fourteen young to nurse. (Of thirteen animals studied, seven had conceptus sites on Day 9.) A second laparotomy was performed on Day 13 if no implantations were observed on Day 9. Three experimental animals that showed no implantation sites on Day 9 were found to have implantations on Day 13 when the number of suckling young was reduced from three to one. Delayed implantation was presumed to have occurred in these animals. The second (or third) laparotomy was performed on Day 17, 21 or 24, if parturition had not occurred by that time.

The same procedures were used for another group of control rats except that they were left to nurse only two young after the laparotomy on Day 9.

The results are summarized in Table 1.

Experimental animals E1 to E7 all had implanted embryos on Day 9. Of the eleven to fourteen young they were then given to nurse, between seven and thirteen were maintained until the time of the second laparotomy. All the experimental animals had flaccid uteri with no evidence of decidual sites at the time of the second laparotomy. From the results for E4, the presence of as few

TABLE 1
EFFECT OF ACCELERATED LACTATION ON PREGNANCY IN THE RAT

Animal no.	No. of sites on Day 9	No. of sites on Day 13	No. of sucking young given after implantation	No. young maintained to last laparotomy	Day of last laparotomy	No. of sites at last laparotomy	Comments
Experimental							
E1	* > 8	NA†	14	13	24	0‡	Uterus flaccid and empty
E2	> 8	NA	14	11	24	0	
E3	> 8	NA	11	8	17	0	
E4	> 8	NA	11	7	17	0	Presumably were in delayed implantation at first laparotomy
E5	> 8	NA	12	12	17	0	
E6	> 8	NA	12	12	17	0	
E7	> 8	NA	12	12	17	0	Implantation sites on one side only
E8	> 8	8	12	9	21	0	
E9	0	8	12	10	21	0	
E10	0	8	12	10	21	0	
Control							
C1	> 5	NA	2	2	17	6‡	Implantation sites on one side only
C2	> 10	NA	2	2	17	14	
C3	> 10	NA	2	2	17	12	
C4	> 5	NA	2	2	17	5	Implantation sites on one side only
C5	> 9	NA	2	2	17	11	
C6	8	NA	2	2	17	8	
C7	10	NA	2	2	17	11	Implantation sites on one side only
C8	10	NA	2	2	17	11	
C9	8	NA	2	2	17	12	
C10	9	NA	2	2	17	0	

* It was frequently difficult to distinguish whether a site contained two very close implantations or only one. Hence, a lower limit of implantations was determined.

† NA = Not applicable.

‡ These results are significant at $P < 0.001$.

as seven nursing young may be associated with the termination of a post-implantation pregnancy within 8 days.

Presumably, delayed implantation occurred in the other three experimental animals, E8 to E10, so that no sites were apparent on Day 9. These animals were therefore given only one young to nurse on Day 9 and implantation was then confirmed on Day 13 at a second laparotomy. They were then given twelve young to nurse, of which they maintained nine or ten. When a third laparotomy was performed on Day 21, all three of these animals also had flaccid uteri.

The control animals, C1 to C10, provided a test of the possible detrimental effects of the laparotomy or any other handling (e.g. see Runner, 1959). They nursed two young throughout the experiment and all but one had foetal-stage embryos on Day 17. In both the experimental and the control rats, the size of the implantation sites on Day 9 varied slightly, but all appeared to be developing normally. The variation could reflect a short delay in implantation resulting from nursing only a few young, as noted by Weichert (1940).

We conclude that heavy lactation after implantation causes termination of pregnancy in rats. These results are consistent with earlier findings concerning the effect of lactation on pituitary hormone levels (e.g. Minaguchi & Meites, 1967; Tucker & Thatcher, 1968).

The precise timing of embryo resorption/abortion caused by lactation and the possible relationships of this occurrence to levels of hormones and/or uterine proteins are being examined.

This work was supported by a National Defense Education Act Title IV grant No. 69-00467 to one of us (M.V.) and by NIH grant No. HD-2282.

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