

PROGESZTERONE CONCENTRATIONS OF NEW ZEALAND RABBITS IN VARIED REPRODUCTIVE PHASES

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Introduction

It is well known that high progesterone levels assure maintenance of pregnancy, and exhibit a monophasic pattern. The highest hormone level in rabbits is attained through days 14-16 of the pregnancy; subsequently there is a gradual decline in these levels. Progesterone values rapidly decrease during the last four days prior to parturition (Ehnbergs, 1979; Hasmat, 1977; Hillard et al., 1973). Rarely have researchers studied the levels of plasma progesterone during the peri-and post-partum periods. Therefore, this investigation was initiated in order to answer the following questions:

1. How do plasma concentrations of hormone differ from the day of insemination and the day that pregnancy can be diagnosed via palpation (day 12)?
2. Do such factors as placentophagia and corpora luteal activity influence the peripartal progesterone levels?
3. Do the corpora lutea still produce a measurable amount of progesterone in the postpartum animal?
4. What progesterone concentrations can be measured in the long-term post-partum period, that is, between parturition and new conception?

Material and methods

White New Zealand rabbits were used for the study. Of the study group (124 does) 104 had delivered 1 litter prior to testing, the remaining 20 were virgin animals.

The does were artificially inseminated with mixed diluted sperm (1.5 million/ml); pregnancy was diagnosed by abdominal palpation. The animals were then divided into four groups as follows:

Group 1 (n=104): blood samples were obtained on day of insemination and day of pregnancy diagnosis.

Group 2 (n=12): blood samples were taken 72 and 24 hours pre-and postpartum, as well as during parturition. Blood was also sampled at 2-3 day intervals following delivery until day 25 post-partum.

Group 3 (n=4) Caesarean sections were performed on these animals one day prior to calculated date of parturition. Both feti and placental membranes were removed. Blood samples were taken 72 and 24 hours prior to and following the surgical procedure, as well as at the time of caesarean section.

Group 4 (n=4): Ovariohysterectomies were performed on these animals one day prior to calculated day of parturition.

Blood sampling done according to schedule for group 3.

The plasma progesterone concentrations were then determined by the EIA method.

Results and discussion

The progesterone plasma levels are of crucial importance at the time of insemination and subsequent conception. During the investigation the measured progesterone values in the does at the time of successful insemination (1.7 nmol/l mean value) corresponded to levels expected during the follicular phase. In the rabbits that later aborted, similar concentrations were also measured.

The rabbits that did not conceive after insemination were divided into 2 groups: (A) progesterone values below 3.18 nmol/l and (B) above this value, at time of insemination.

The latter group gives evidence of several does having progesterone concentrations beyond that normally seen in the follicular phase. According to the literature two sources of progesterone can be identified in the female: the corpus luteum and the adrenal glands. It is believed that the rise in progesterone levels is attributable to luteal function (Challis et al., 1973; Hasan et al., 1971). Generally, ovulation in rabbits occurs after copulation, but the occurrence of ovulation without copulative induction has been established. For instance, the proximity of a buck or bucks or more infrequently the mode of handling can at times trigger ovulation in a sensitive receptive doe. Also, the does themselves can induce rupture of the follicles by mounting on each other. After this type of ovulation (that is, without copulation), there begins a luteal phase which is shorter in duration (18-21 days) than the normal gestation. This condition is known as false pregnancy (or pseudocyesis). A state of false pregnancy may also be induced by the administration of various hormonal preparations, such as LH, HCG or GnRH (Paufler et al., 1979; Gábor et al., 1987). One can account for the does having such marked elevations in progesterone concentrations at the time of insemination by assuming that they were in a state of pseudocyesis (Asdell, 1964). On day 12 of pregnancy (at the point of positive clinical diagnosis) nearly all does had a progesterone concentration greater than 20 nmol/l. This included does that were not pregnant clinically, these animals having been given a preparation of LH or GnRH at the time of insemination. The hormonally treated does also exhibited signs typical to a so-called "pseudoparturition", that is, excitement, hair pulling, nesting behavior, etc.

The results of this study point to two facts: 1.) progesterone levels alone cannot be used to determine pregnancy, and 2.) false pregnancy can only be diagnosed with accurate clinical palpation as well as determination of progesterone elevation.

Findings from the experiment could not substantiate the postulate that placentophagia contributes to plasma progesterone levels (Figure 1.) The does that ingested fetal membranes shortly after normal parturition did not show significant elevations in plasma progesterone.

In the does that underwent caesarean section, blood samples showed an increase in progesterone levels between the time of surgery and 24 hours post-op. One must remember, however, that C-sections were performed one day prior to expected parturition, and therefore complete luteolysis had not yet occurred.

The ovariectomized does demonstrated that the corpora luteal activity does not totally cease post-partum as indicated by the sharp decline of progesterone after removal of the ovaries (Figure 2.).

Following parturition, a slight elevation in plasma progesterone levels could be detected in does that delivered naturally with values nearing the upper limit seen during the follicular phase (3.18 nmol/l). This further strengthens the hypothesis that there is still some ovarian production of progesterone postpartum. These post-partum results were also obtained by Munsel et al.

Table

Mean progesterone concentrations at the time of insemination and pregnancy diagnosis

Success of Insemination	Plasma progesterone nmol/l	
	Insemination (day 0.)	Pregnancy diagnosis (day 12.)
Conceived and Delivered	1.7 ± 1.3	31.7 ± 12.1
Conceived and Aborted	1.7 ± 0.6	28.6 ± 11.2
Not Conceived "A"	1.9 ± 0.9	26.0 ± 12.8 [*]
Not Conceived "B"	11.9 ± 5.1 [*]	8.2 ± 4.1

*Pseudocyesis

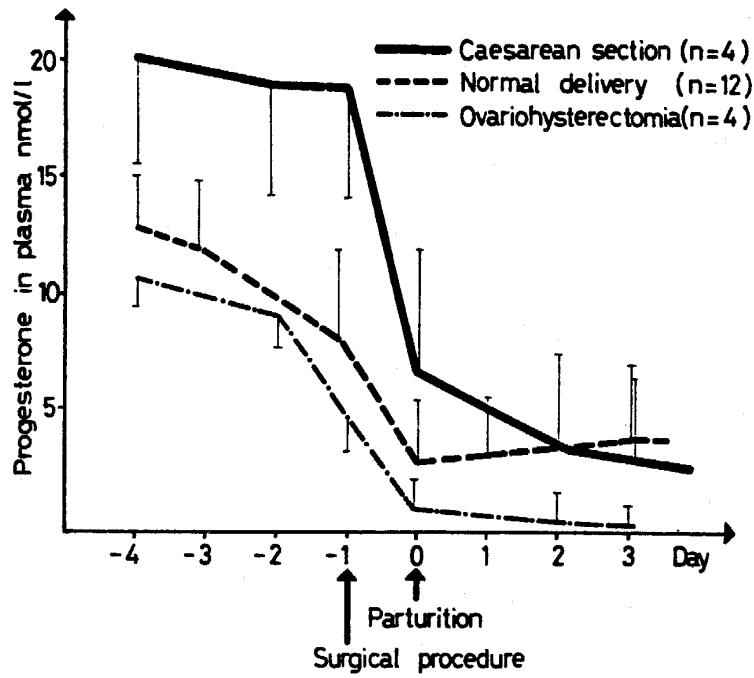


Figure 1. Mean peripartal progesterone values in does delivered in different way

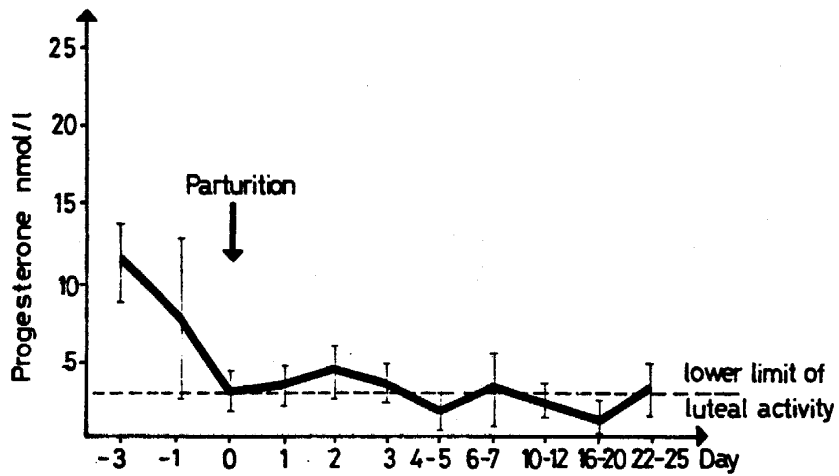


Figure 2. Peri- and postpartal progesterone concentrations in plasma of does with normal delivery

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Progesterone concentration of blood plasma was studied in New Zealand white does at the time of mating, during the perinatal period and up to the 25th day postpartum. In order to determine the progesterone source in time, Caesarean section, as well as ovariectomy was carried out in four does each. The progesterone levels were about 1.7 nmol/l in the conceived does. In a small percentage (9% of all matings) high (11.9-5.1 nmol/l) progesterone levels were measured in the non-conceived does. High plasma progesterone concentrations, measured at the time of mating, are explained by pseudopregnancy. The slightly higher than 3.18 nmol/l progesterone levels measured in does with regular birth or with Caesarean section up to the 72nd hour of early puerperium are traced back to the protraction of luteal activity. I. e. in does after ovariectomy, the measured progesterone plasma concentrations were below 2.1 nmol/l during the same period. Between the 4th and 25th day postpartum, the level of progesterone varied at a level of approx. 3 nmol/l and below this value.

BLUTPROGESTERONKONZENTRATIONEN BEI NEUSEELÄNDERKANINCHEN IN VERSCHIEDENEN
FORTPFLANZUNSBIOLOGISCHEN PHASEN

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In Untersuchungen mit Weissen Neuseeländerkaninchen ermittelte man die Progesteronkonzentration im Blutplasma in der Besamungszeit, in der peripartalen und postpartalen Periode an 25 aufeinanderfolgenden Tagen. Zur Präzisierung der Progesteronquelle wurde in je 4 trächtigen Muttertieren ein Kaiserschnitt bzw. eine Ovariectomy durchgeführt. Die Progesteronwerte lagen bei etwa 1,7 nmol/l in den konzipierten Häsinnen; in einem geringen Anteil der nicht konzipierten Tierzahl (in etwa 9% der belegten Muttertieren) wurden hohe Werte von 11,9-5,1 nmol/l gemessen. Die zur Zeit der Belegung gemessenen hohen Plasmakonzentrationen sind auf das Bestehen von Scheinträchtigkeit zurückzuführen. In Häsinnen mit normaler Geburt, und in solchen mit Schnittenbindung, wurden im frühen Puerperium, bis zur 72. Stunde, Progesteron-Plasmakonzentrationen von 3,18 nmol/l oder um ein geringes mehr gefunden, wahrscheinlich wegen Verzögerung der Gelbkörperaktivität, in ovariectomisierten Muttertieren wurden nämlich zu dieser Zeit Werte von 2,1 nmol/l gemessen. Vom 4. bis 25. Tag nach der Geburt betrug die Progesteronkonzentration etwa 3 nmol/l.

