Ann. Biol. anim. Bioch. Biophys., 1979, **19** (5), 1575-1587.

The effects of œstradiol benzoate (OB) and gonadotrophin releasing hormone (GnRH) on reproductive activity in beef cows at different intervals post partum

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Summary. Three experiments were carried out to determine the effects of OB and GnRH on beef suckler cows at various stages *post partum*.

In experiment 1, the first *post partum* œstrus occurred at 36 $\pm$ 17 (mean $\pm$ SD), 44 $\pm$ 25 and 43 $\pm$ 22 days *post partum* for animals injected with 400 μg OB or 100 μg GnRH at days 15 and 30 *post partum* and controls, respectively. The first *post partum* ovulation, based on elevated plasma progesterone levels, occurred at 37 $\pm$ 17 (mean $\pm$ SD), 31 $\pm$ 18 and 34 $\pm$ 10 days *post partum* for these three groups, respectively. Neither OB nor GnRH increased the numbers of animals which exhibited LH peaks at day 15 or 30 *post partum* or which showed a subsequent rise in plasma progesterone. There was a high proportion of silent ovulations early in the *post partum* period.

In experiment 2, the time from parturition to the first subsequent œstrus was 93 $\pm$ 18 days for animals given 20 μg of an LHRH analogue (Hoe 766) between days 37 and 77 *post partum*, and 86 $\pm$ 28 days for controls. Significantly more ($P < 0.01$) treated cows than controls had elevated plasma progesterone levels following the time of treatment.

In experiment 3, animals given two injections of 100 mcg progesterone and one injection 20 μg Hoe 766 at two day intervals between days 26 and 87 *post partum* had an interval between calving and first subsequent œstrus of 81 $\pm$ 22 days (mean $\pm$ SD) and this interval for controls was 83 $\pm$ 13 days. Five of seven treated animals exhibited œstrus 21-22 days after treatment suggesting occurrence of a silent ovulation after treatment.

Introduction.

Beef cows have a longer interval from calving to the resumption of cyclic ovarian activity than dairy cows. They also have a greater incidence of silent ovulations prior to the first *post partum* oestrus (Wiltbank and Cook, 1958 ; Wagner and Hansel, 1969 ; Casida, 1971). This prolonged *post partum* anoestrous period in beef cows is economically undesirable as it makes it difficult for the farmer to optimize production. Suckling frequency and intensity affect the duration of the *post partum* anoestrous period (Short *et al.*, 1972 ; England *et al.*, 1973 ; Randel and Welker, 1976 ; Wette-

man *et al.*, 1976 ; Wyatt *et al.*, 1977). However, the exact mechanisms by which suckling depresses reproductive activity are largely unknown.

Various management and hormonal treatments have been used in attempts to induce an earlier *post partum* fertile oestrus in beef cows. Management practices include early or temporary weaning of calves or restricting suckling (Smith and Vincent, 1972 ; Laster *et al.*, 1973 ; Bellows *et al.*, 1974 ; La Voie and Moody, 1976 ; Randel and Welker, 1976 ; Short *et al.*, 1976 ; Baud and Cummins, 1977 ; Holness, Hopley and Hale, 1978). Hormonal treatments carried out have included the administration of steroid hormones, gonadotrophins and hypothalamic releasing factors at various stages *post partum* (Brown *et al.*, 1972 ; Smith and Vincent, 1972 ; Radford *et al.*, 1978 ; Entwistle and Oga, 1977 ; Mulvehill and Sreenan, 1977 ; Nancarrow *et al.*, 1977). Variation in response to these different treatments highlights the need for more work on the induction of ovulation in the *post partum* beef cow. Hormonal responses to hypothalamic stimulation at different times *post partum* may indicate whether the hypothalamus, ovaries, or both, are in a refractory state and how this may be overcome.

The aim of the experiments reported in this paper was to determine the effects on reproductive activity of OB or GnRH injected with or without progesterone pretreatment at different *post partum* intervals. Reproductive activity was assessed by measuring plasma levels of LH and progesterone and from the occurrence of œstrous behaviour and ovulation.

Materials and methods.

All three experiments were carried out using spring calving beef (mainly Hereford crossbred) suckler cows. Cows were run at pasture with vasectomised teaser bulls fitted with chin-ball marking devices and checked for signs of œstrus at least twice daily.

Plasma hormone levels were used to determine the occurence of luteinising hormone (LH) peaks and ovulation. Plasma LH levels were determined by radioimmunoassay unsing the method described by Hanrahan, Quirke and Gosling (1977) but substituting LER 1716-2 and NIH-LH-B9 bovine LH for the standard curve and for iodination. The radioimmunoassay method described by Gosling, Parker and Fottrell (1975) was used for plasma progesterone measurements.

An LH peak was defined as plasma LH values above 5 ng/ml for more than 4 hrs or above 10 mg/ml for more than 2 hrs. A rise in plasma progesterone to luteal levels (> 1 ng/ml) was considered due to ovulation if levels remained high for at least 10 days.

Experiment 1

The purpose of this experiment was to determine whether injections of OB or GnRH on days 15 and 30 *post partum* would cause LH release and ovulation in beef suckler cows.

Thirty-three primiparous cows were assigned, according to date of parturition, to three groups with 11 animals in each group. Animals in the first group received a

single intramuscular injection of 400 μg OB in corn oil on day 15 and again on day 30 *post partum*. Animals in the second group received a single intramuscular injection of 100 μg GnRH in saline on day 15 and again on day 30 *post partum*. Animals in the third group were designated as controls and received no treatment.

Daily blood samples were collected from all animals by jugular venipuncture from day 10 until day 90 *post partum* or until they had exhibited two consecutive œstrous periods and analysed for plasma progesterone levels. Hourly jugular blood samples were taken from each cow from zero to 30 hrs after the time of each injection and analysed for plasma LH levels.

In order to determine the effect of GnRH and OB on LH release during the follicular phase of the oestrus cycle, seven cyclic animals were injected on day 18 or 19 of the cycle (oestrus = day 0). Three cows and one heifer were given 100 μg GnRH and two cows and one heifer were given 400 μg OB. Hourly blood samples were taken for LH analysis from zero to 30 hrs after injection.

Experiment 2

The purpose of this experiment was to determine whether or not a single injection of LHRH would shorten the *post partum* interval to first oestrus in beef suckler cows.

Thirty-two primiparous cows between days 37 and 77 post partum (mean day 52 ± 10 SD) were allocated according to date of parturition into two groups. One group, containing 17 animals, received no treatment and were designated a controls. The second group, containing 15 animals, received a single intramuscular injection of 20 μg of an LHRH analogue, Hoe 766 (Hoechst Pharmaceuticals Ltd.).

Rectal palpation was carried out on all animals to determine ovarian activity at the start of the experiment. Normal sized ovaries with detectable structures were classified as active and small ovaries with no detectable structures were classified as inactive. No distinction was made between palpable structures on the ovaries.

Blood samples for progesterone analysis were taken from all animals by jugular venepuncture just prior to the time of Hoe 766 injection (day 0) and on days 4, 6 and 8 following injection.

Experiment 3

The purpose of this experiment was to determine the effects of a progesterone pre-treatment in conjunction with a single injection of LHRH during the post partum period on the *post partum* interval to first oestrus in beef suckler cows.

Sixteen multiparous cows between days 26 and 87 *post partum* (mean day 45 ± 16 SD) were blocked according to *post partum* interval into groups of two, and animals within blocks randomly assigned to a control or a treatment group. The treatment group, containing nine animals, received two intramuscular injections of 100 mg progesterone in 5 ml corn oil two days apart. They then received a single intramuscular injection of 20 mcg Hoe 766 two days after the second progesterone injection.

Blood samples for plasma progesterone analysis were taken from all animals immediately before the time of each injection and on days 4, 7 and 9 following the Hoe 766 injection (day 0).

Results.

Experiment 1

Oestrus and ovulation. — The numbers of animals detected in oestrus within five days of treatment at day 15 were 2/11, 1/11 and 0/11 and at day 30 *post partum* were 2/10, 0/11 and 2/11 for animals given OB or GnRH and controls, respectively. Oestrus periods detected at other times were not considered to be a direct consequence of treatment. Similarly, the numbers of animals considered to have ovulated in response to treatment at day 15 were 1/11, 2/11 and 1/11, and at day 30 were 1/10, 0/11 and 2/11 for animals given OB, GnRH and controls, respectively (table 1). These animals remained cyclic throughout the experimental period.

TABLE 1

Oestrus and ovulation (1) *following injection of* OB *or* GnRH *at days* 15 *and* 30 post partum

	Day 15			Day 30		
	No. treated	No. in oestrus (2)	No. ovulated (2)	No. treated	No. in oestrus (2)	No. ovulated (2)
OB.....	11	2	1	10 (3)	2	1
GnRH	11	1	2	11	0	0
Controls ..	11	0	1	11	2	2

(1) Determined by a rise in progesterone levels.
(2) Within 5 days of treatment.
(3) One animal sick.

TABLE 2

Post-partum *interval to oestrus and ovulation* (1) *in animals given* OB *or* GnRH *at days* 15 *and* 30 post partum

	OB	GnRH	Controls
No. treated	11	11	11
No. in oestrus (2)	9	10	8
Days to first oestrus (mean ± SD) =			
(a) animals detected	36 ± 17	44 ± 25	43 ± 22
(b) animals detected + animals assigned 90 days.	46 ± 27	48 ± 27	56 ± 29
No. ovulated (2)	8	11	9
Days to first ovulation (mean ± SD) =			
(a) animals ovulated	37 ± 17	31 ± 18	34 ± 10
(b) animals ovulated + animals assigned 90 days .	52 ± 29	31 ± 18	44 ± 25

(1) Based on progesterone rise of > 1 ng/ml for at least 10 days.
(2) During the 90-days experimental period.

The *post partum* intervals for animals treated with OB or GnRH and controls, respectively, were 36 ± 17, 44 ± 25 and 43 ± 22 days (mean ± SD) for those animals which exhibited oestrus during the 90 days experimental period and 46 ± 27, 48 ± 27 and 56 ± 29 days when the six animals which did not show oestrus during the experimental period were assigned *post partum* intervals of 90 days. Similarly the intervals to first ovulation for animals treated with OB or GnRH and controls, respectively were 37 ± 17, 31 ± 18 and 34 ± 10 days (mean ± SD) for those animals which ovulated during the experimental period and 52 ± 29, 31 ± 18 and 44 ± 25 days when the four animals which did not ovulate were assigned a value of 90 days (table 2). None of these differences among the three groups were significant.

There was a high proportion of silent ovulations in animals given GnRH and in control animals, whereas two animals given OB exhibited anovulatory oestrous periods. One animal in the OB-treated group and two of the control animals did not exhibit oestrus and had low (< 1 ng/ml) plasma progesterone levels throughout the experimental period (table 3).

TABLE 3

Relationship of first oestrus to ovulation in animals given OB *or* GnRH *at days* 15 *and* 30 post partum

Treatment	Anovulatory oestrus	Silent ovulation	Oestrus and ovulation	Anoestrus during experiment	Total
OB	2	1	7	1	11
GnRH.....	—	5	6	—	11
Controls.....	—	3	6	2	11

TABLE 4

Occurrence of LH *peaks in relation to plasma progesterone levels in animals given* OB *or* GnRH *at days* 15 *and* 30 post partum

	Day 15				Day 30			
	GnRH	OB	Controls	Total	GnRH	OB	Controls	Total
No. treated	11	11	11	33	11	10 (1)	11	32
No. with P < 1 ng/ml at time of injection	11	11	10	32	6	9	9	24
No. of these with LH peaks	3	5	1	9	3	2	1	6
No. with P > 1 ng/ml at time of injection	0	0	1	1	5	1	2	8
No. of these with LH peaks	0	0	0	0	0	0	0	0

(1) One animal sick.

LH. — The incidence of LH peaks following the time of injection did not differ significantly among the three groups at either day 15 or day 30 *post partum* (table 4). The plasma progesterone level at the time of injection affected the LH response. On day 15 *post partum* plasma progesterone levels were low (< 1 ng/ml) in all animals except one control and LH peaks were detected in three of the 11 GnRH treated animals, five of the 11 OB treated animals and one control (table 4). Plasma progesterone levels were high (> 1 ng/ml) in eight of the thirty-two animals on days 30 *post partum*. None of the animals with high progesterone levels at day 15 or day 30 *post partum* had LH peaks. In the animals with low progesterone levels on day 30, 3/6 GnRH treated animals, 2/9 OB treated animals and 1/9 controls had LH peaks. All seven cyclic animals injected with GnRH or OB during the follicular stage of the oestrous cycle exhibited LH peaks (table 5). The incidence of LH peaks following OB or GnRH administration was greater in cyclic than in *post partum* animals ($P < 0.05$).

TABLE 5

Characteristics of LH *peaks in animals given* OB *or* GnRH *at days* 15 *and* 30 post partum *or during the follicular phase of the oestrous cycle*

	No. treated	No. with LH peaks	Time to peak onset (hrs) (1)	Peak height (ng/ml)	Duration (hrs)	Area under peak (units of area)
Day 15						
GnRH (2).....	11	3	1.7 ± 2.1	21 ± 6	3.7 ± 0.5	121 ± 68
OB	11	5	17.4 ± 3.9	49 ± 18	7.2 ± 1.3	286 ± 65
Controls	11	1	—	86	5	265
Day 30						
GnRH	11	3	0.5 ± 0	51 ± 48	7.8 ± 2.5	224 ± 118
OB	10	2	22.0 ± 8.5	71 (3)	9 (3)	303 (3)
Controls	11	1	—	34	6	152
Follicular						
GnRH	4	4	1.0 ± 0	42 ± 14	6.8 ± 0.5	179 ± 45
OB	3	3	18.6 ± 3.5	45 ± 16	7.7 ± 0.6	230 ± 63

Values are mean ± SD

(1) Onset earlier following GnRH ($P < 0.05$) for all 3 periods.
(2) Duration and area of peak shorter ($P < 0.01$) than other values.
(3) Values available for one animal only.

The time from injection to the onset of the LH peak was significantly longer ($P < 0.005$) following OB than following GnRH injection in both *post partum* and cyclic cows (table 5). Following GnRH administration on day 15 *post partum* the duration of the LH peak was significantly shorter ($P < 0.01$) and the height of

the peak was smaller, although not significantly. Thereafter there were no differences (fig. 1).

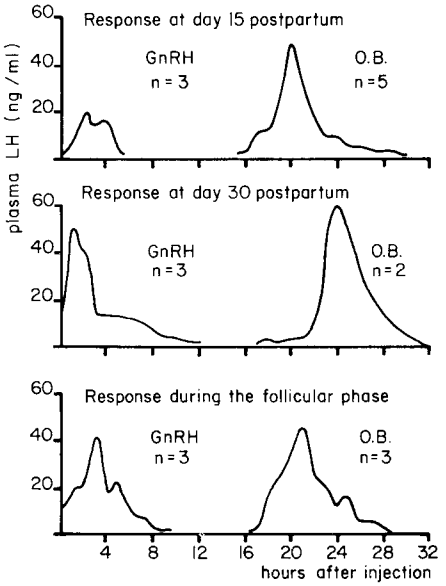

FIG. 1. — LH *secretion following injection of* 100 μg GnRH *or* 400 μg OB *at day* 15 *or* 30 post partum *or during the follicular phase of the oestrous cycle.*

Progesterone. — Treatment did not affect the numbers of animals with low plasma progesterone (< 1 ng/ml) at the time of treatment showing a rise in progesterone levels of greater than 1 ng/ml within five days of treatment at day 15 or day 30 *post partum*

TABLE 6

Effects of treatment and LH *levels on plasma progesterone levels following* OB *or* GnRH *administration at days* 15 *and* 30 post partum (1)

	Day 15		Day 30	
	No. Animals	No. with Prise	No. Animals	No. with Prise
Treatment Effects				
OB	11	4	9	6
GnRH	11	4	6	5
Controls	10	3	9	5
Total	32	11	24	16
LH Effects				
LH peak after treatment	9	6 (2)	6	4
No LH peak after treatment	23	5 (2)	18	12
Total	32	11	24	16

(1) Excluding animals with high P at time of treatment.
(2) Values significantly different ($P < 0.05$).

(table 6). The occurrence of an LH peak significantly ($P < 0.05$) increased the numbers of animals with a subsequent progesterone rise at day 15 *post partum* but had no effect at day 30.

The daily plasma progesterone levels in animals with low progesterone at the time of treatment were summed between days 16 and 30 and days 31 and 45 *post partum*. There were no differences among treatments at either stage *post partum* but the mean progesterone secretion was significantly higher ($P < 0.01$) for days 31 to 45 (mean $\pm$ SD : 20.6 $\pm$ 18.7 ng/ml) than for days 16 to 30 (mean $\pm$ SD : 8.7 $\pm$ 8.6 ng/ml) (table 7). The mean of the summed daily progesterone secretion during normal cycles of 19 to 22 days in experimental animals which had resumed cyclic activity was 48.0 $\pm$ 13.1 ng/ml. The mean daily progesterone secretion was significantly higher ($P < 0.01$) during a normal cycle than during days 31 to 45 *post partum*, being 2.4 $\pm$ 0.6 ng/ml/day and 1.4 $\pm$ 1.3 ng/ml/day (mean $\pm$ SD) for these two periods, respectively.

TABLE 7

Means ($\pm$ SD) *of summed daily progesterone secretion* (ng/ml) *during days* (16-30 *and* 31-45 post partum (1)

	Days post partum			
	16-30		31-45	
	No. treated	P	No. treated	P
GnRH	11	10.5 $\pm$ 7.1	6	30.9 $\pm$ 21.4
OB	11	7.2 $\pm$ 8.7	9	17.6 $\pm$ 16.7
Controls	10	8.3 $\pm$ 10.7	9	18.3 $\pm$ 19.1
Total	32	8.7 $\pm$ 8.7 (2)	24	21.2 $\pm$ 18.9 (2)

(1) Excluding animals with high P at time of treatment.
(2) Values significantly different ($P < 0.01$).

TABLE 8

Plasma progesterone profiles and interval to first oestrus in primiparous cows given Hoe 766 *at various stages* post partum (*experiment* 2)

Ovarian activity before treatment	Hoe 766			Controls		
	Active	Inactive	Total	Active	Inactive	Total
No. treated	6	9	15	6	11	17
No. with P rise after treatment ..	5 (1)	5 (2)	10 (3)	0 (1)	0 (2)	0 (3)
Interval from treatment to oestrus (mean $\pm$ SD days)	38 $\pm$ 14	50 $\pm$ 20	42 $\pm$ 17	31 $\pm$ 17	42 $\pm$ 20	38 $\pm$ 19
Post-partum interval (mean $\pm$ SD days)	90 $\pm$ 15	96 $\pm$ 22	93 $\pm$ 18	77 $\pm$ 38	91 $\pm$ 22	86 $\pm$ 28

Values with the same superscript significantly different.
(1), (2) $P < 0.05$; (3) $P < 0.01$.

Experiment 2

Rectal palpation indicated similar numbers of cows in both the treated and control groups had active ovaries prior to treatment (table 8). Ten of the 15 treated cows had elevated plasma progesterone levels within seven days of Hoe 766 administration. Plasma progesterone levels in the control cows remained low (< 1 ng/ml) throughout the seven day experimental period. This difference in plasma progesterone levels is significant ($P < 0.01$) and is independent of ovarian activity at the time of treatment. In contrast, Hoe 766 did not induce oestrous behaviour in the treated cows, either following the time of injection or a cycle length (19-24 days) later. The interval from time of injection to oestrus was 42 ± 17 days (mean $\pm$ SD) for the treated cows and 38 ± 19 days for the controls. The *post partum* interval was also similar for the two groups (table 8).

Experiment 3

A higher proportion of cows treated with progesterone and Hoe 766 than controls showed a subsequent rise in plasma progesterone levels greater than 1 ng/ml within seven days of the time of treatment, but this difference was not statistically significant (table 9). The interval from Hoe 766 administration to the first subsequent oestrus was 30 ± 13 days (mean $\pm$ SD) for the treated animals and 37 ± 12 days for the controls. The *post partum* interval was 81 ± 22 and 83 ± 13 days (mean $\pm$ SD) for the treated and control animals, respectively (table 9). Although there were no statistical differences in the occurrence of oestrus between the two groups, five of the seven treated cows showing a rise in plasma progesterone following treatment were observed in oestrus 21 to 22 days after Hoe 766 administration.

TABLE 9

Plasma progesterone profiles and interval to first oestrus in multiparous cows given progesterone and Hoe 766 *at various stages* post partum (*experiment* 3)

	Progesterone + Hoe 766	Controls
No. treated	9	7
No. with P rise after treatment	7 (1)	2
Interval from treatment to oestrus (mean $\pm$ SD days)	30 ± 13	37 ± 12
Post partum interval (mean $\pm$ SD days)	81 ± 22	83 ± 13

(1) 5 of these exhibited oestrus 21-22 days after Hoe 766.

Discussion.

It is well documented in the literature that GnRH causes LH release in cattle, sheep and pigs and the response in the female is enhanced by oestrogen (Convey, 1973). Cummins *et al.* (1972), Wetteman *et al.* (1972) and Echternkamp and Hansel (1973) suggest oestrogen is the trigger for the pre-ovulatory LH peak in the cyclic cow.

Schams *et al.* (1973) and Britt, Kittok and Harrison (1974) both found that the administration of GnRH to the *post portum* dairy cow induced earlier oestrus and ovulation although Schams *et al.* (1973) found the length of the subsequent oestrous cycle to be abnormal. Saiduddin, Quevedo and Foote (1968) found oestradiol alone or following progesterone treatment, initiated earlier oestrus and ovulation in the *post partum* beef cow.

The results of the experiments in this study showed no effect of injecting either OB or GnRH on the *post partum* interval and first *post partum* ovulation in beef suckler cows. In experiment 1, both GnRH and OB induced LH peaks during the follicular phase in cyclic animals but neither treatment increased the incidence of LH peaks in *post partum* animals. No relationship was found between the overall incidence of LH peaks and a subsequent rise in plasma progesterone levels in *post partum* animals. However, at day 15 *post partum*, more animals with than without LH peaks showed a rise in progesterone, regardless of treatment.

Radford, Nancarrow and Mattner (1978) and Nancarrow *et al.* (1977) found the ovulation response to oestrogen increased with the stage of the *post partum* period at which treatment was given in suckled beef cows. Echternkamp (1978) found suckling suppressed gonadotrophin secretion in beef cows before day 42 *post partum*. However, the results of experiment 1 show the incidence of LH peaks following either treatment was not influenced by the *post partum* interval at the time of treatment. The incidence of LH peaks was affected by the level of progesterone at the time of treatment. Animals with high progesterone (> 1 ng/ml) did not exhibit LH peaks. This is similar to results following oestrogen administration in cyclic ewes (Bolt, Kelley and Hawk, 1971 ; Howland, Akbar and Stormshak, 1971) and in cattle (Hobson and Hansel, 1972).

Induced LH peaks were similar to normal pre-ovulatory LH peaks as described by Henricks, Dickey and Niswender (1970) and Swanson and Hafs (1971), except following GnRH administration at day 15 *post partum*. Kesler *et al.*, (1977) and Fernandes *et al.*, (1978) both found LH release following GnRH in dairy cows was lower before day 10 *post partum*. The magnitude of the LH release seems to be associated with circulating oestrogen levels (Kesler *et al.*, 1977) and with the LH content of the pituitary which increases during the *post partum* period (Saiduddin *et al.*, 1966). Thus, injecting OB rather than GnRH during the early *post partum* period may facilitate a greater release of LH, as seen in experiment 1, but this does not necessarily induce ovulation.

The effect of *post partum* interval rather than the administration of GnRH or OB on *post partum* reproductive activity in beef cows is further borne out by plasma progesterone levels in animals on experiment 1. In animals where treatment did not induce an LH peak the occurrence of elevated plasma progesterone levels can be attributed to spontaneous resumption of ovarian activity. The incidence of elevated progesterone levels in such animals is greater at day 30 than at day 15 *post partum*. The total progesterone secretion was greater in the period from day 31 to 45 than that from day 16 to 30 *post partum*. Neither of these factors was affected by treatment. This suggests few animals had spontaneously resumed ovarian activity before day 15 *post partum* and a greater number had resumed activity by day 30.

In experiment 1, eight of the 11 animals at day 15 and nine of the 16 animals at day 30 which showed a rise in plasma progesterone levels following treatment had lower progesterone profiles than those normally associated with ovulation. Small

rises in plasma progesterone were detected prior to first *post partum* oestrus in beef heifers by Corah *et al.* (1974) and Humphrey (1977). These initial progesterone rises are attributed to silent ovulations in both heifers (Castenson *et al.*, 1976) and cows (Robertson, 1972 ; La Voie and Moody, 1976). In animals on experiment 1, a high proportion of plasma progesterone rises, similar to those in the luteal phase of cyclic animals, were not preceeded by oestrus, especially following GnRH administration. Gonzalez-Padilla, Niswender and Wiltbank (1975) found oestradiol induced LH peaks in pre-puberal heifers but they did not ovulate unless they had been primed with progesterone prior to oestrogen treatment. This is similar to Hoe 766 administration in experiments 2 and 3. The progesterone primed animals on experiment 3 showed a rise in plasma progesterone followed by oestrus 21 days later, whereas animals on experiment 2 which had not received progesterone showed no response.

In conclusion, none of the treatments in these three experiments shortened the *post partum* interval. The interval from parturition to first ovulation, as determined from plasma progesterone levels, was not shortened by the administration of either GnRH or OB.

EEC Seminar on « Ovarian stimulation and egg quality in mammals », Luynes, France, octobre 1978.

Acknowledgements. — Thanks are due to Dr. F. J. Harte for providing facilities ; Mr. D. Prendiville for excellent technical assistance ; Mrs. A. Glynn and Mr. G. McLoughlin for hormone analysis ; Mr. J. Sherrington for statistical analysis ; Hoechst Pharmaceuticals for Hoe 766. This work was financially supported by the Commission of the European Communities.

Résumé. Trois expériences ont été réalisées pour déterminer les effets du benzoate d'œstradiol et du GnRH sur les vaches à viande à différents stades *post-partum*.

Dans l'expérience 1 (traitement estradiol ou GnRH), le premier œstrus *post-partum* est survenu respectivement à 36 ± 17 (moyenne + SD), 44 ± 25 et 43 ± 22 jours *post-partum* chez des animaux injectés avec 400 µg de benzoate d'œstradiol ou 100 µg de GnRH aux jours 15 et 30 *post-partum* et chez des témoins. La première ovulation *post-partum*, estimée d'après les niveaux de progestérone dans le sang, est survenue à 37 ± 17 (moyenne $\pm$ SD), 31 ± 18 et 34 ± 10 jours *post-partum* respectivement pour ces trois groupes. Ni le benzoate d'œstradiol, ni le GnRH n'ont augmenté les nombres d'animaux montrant des pics de LH à 15 et 30 jours *post-partum* ou montrant une augmentation de progestérone dans le sang. Il y a eu une grande proportion d'ovulations silencieuses tôt durant la période *post-partum*.

Dans l'expérience 2, (GnRH seul), le temps entre la parturition et le premier œstrus suivant a été de 93 ± 18 jours pour les animaux traités avec 20 µg d'un analogue de LH-RH (Hoe 766) entre les jours 37 et 77 *post-partum*, et 86 ± 28 jours pour les témoins. Significativement plus ($P < 0.01$) de vaches traitées que de témoins ont eu des niveaux de progestérone élevés dans le sang après le traitement.

Dans l'expérience 3, prétraitement progestérone, puis GnRH, les animaux ayant reçu deux injections de 100 µg de progestérone et une injection de 20 µg de GnRH (Hoe 766) à deux jours d'intervalle entre les jours 26 et 87 *post-partum*, ont eu un intervalle entre la mise-bas et le premier œstrus suivant de 81 ± 22 jours (moyenne $\pm$ SD) et cet intervalle pour les témoins était de 83 ± 13 jours. Cinq sur sept des animaux traités ont montré un œstrus 21-22 jours après le traitement suggérant la possibilité d'une ovulation silencieuse après traitement.

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