OESTROGEN-INDUCED LH SURGES IN THE ANOESTROUS AND CYCLIC EWE

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Goding, Catt, Brown, Kaltenbach, Cumming & Mole (1969) found that intramuscular injection of 50 µg oestradiol-17β in four anoestrous ewes was followed by a typical oestrous peak of LH secretion. Plasma LH peaks of 150 to 200 ng/ml were seen 12 to 18 hr after injection. The duration of elevated levels was similar to that associated with oestrus (approx. 10 hr).

In this study, five 2-year-old maiden Cheviot ewes were injected subcutaneously with 50 µg oestradiol-17β (Sigma Chemical Co. Ltd) in 1·0 ml of 0·9% saline during their mid-anoestrous period (June 1972) and again during their sixth cycle of the following breeding season (January 1973). Four of the animals were injected on Day 1 of their cycle (Day 0 = day of oestrus) and the fifth was injected on Day 6. Blood samples were taken by venipuncture from the jugular vein (using heparinized 10-ml Vacutainers; Becton, Dickinson U.K. Ltd) just before the injection of oestradiol and at 30, 60, 90 and 120 min after the injection; thereafter, samples were taken at 2-hourly intervals for the following 22 hr. Plasma was separated from the blood samples and stored at −15°C until assayed for oestradiol-17β and LH.

Oestradiol-17β was measured in the samples up to 4 hr after injection using a radioimmunoassay (RIA) system previously described (Symons, 1973). Levels of LH were measured in all the samples using a solid-phase RIA system which was first described by Catt & Tregear (1968) and subsequently modified by Cunningham & Hebert (1973) for the measurement of ovine FSH. The ovine LH assay utilized iodinated NIH-LH-B8 as the radioactive LH and NIH-LH-S17 as the standard. Horse serum (No: 5, Wellcome Reagents Ltd) was the diluent for standards and plasma samples. Purification of the iodinated hormone before each assay was performed using cellulose adsorption chromatography (Jeffcoate, 1971). It was found that bovine LH and ovine LH (NIH standards) reacted identically in the assay. Text-figure 1 shows the results obtained in the individual ewes. Basal levels of oestradiol-17β were below 5 pg/ml in all animals at the times used, this being the limit of detection of the assay under the conditions used. Jugular venous plasma levels rose to peaks of 30 to 70 pg/ml in either the 30- or 60-min sample after injection. Levels were approaching pre-injection levels in the 4-hr sample. Basal levels of LH in the anoestrous ewes and at the time of use, when they were cycling, were below 1 ng/ml plasma. In all five ewes during anoestrous, LH began to rise 10 hr after

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Text-fig. 1. Levels of oestradiol-17β in jugular venous plasma following subcutaneous (s.c.) injection of 50 µg oestradiol-17β in five ewes when anoestrous and cycling (○), and levels of LH induced following injection of oestradiol-17β in the ewes (●).
oestradiol injection and reached peak levels of 96 to 182 ng/ml in the 12-, 14- or 16-hr sample. Two of these anoestrous ewes were injected with the same dose of oestrogen (50 µg) 24 hr after the first injection and LH levels were monitored for a further 24 hr. The time course for the LH response was similar to that from the first injection but the peak levels were very much reduced (19·0 and 33·0 ng/ml).

When cycling, the ewes showed very little if any response to the same dose of oestrogen given on Day 1 in four animals and Day 6 in the fifth. Peak levels remained below 1 ng/ml in one ewe treated on Day 1 and also in the ewe treated on Day 6. In the other three animals treated on Day 1, peaks of 2·2, 3·7 and 21·3 ng LH/ml were obtained. The oestrogen profile after injection, however, was very similar to that seen when the ewes were anoestrous. Treatment of these cycling ewes with oestrogen did not alter their normal cycle length.

Our results suggest that oestrogen-induced LH surges in the ewe depend on the seasonal state of the animal as well as on LH secretion the preceding day. Bolt, Kelley & Hawk (1971) showed that intramuscular injection of oestradiol consistently induced LH release in cyclic ewes on Day 3. Injection on Day 10 did not cause consistent release of LH. They, however, used a much higher dose of oestradiol (1 mg) and the peaks of LH observed (10 to 35 ng/ml) were well below those reported here and by Goding et al. (1969) from 50 µg injections in anoestrous ewes.

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