THE INFLUENCE OF OVARIECTOMY ON LUTEINIZING HORMONE CONCENTRATIONS IN ANESTROUS AND CYCLIC SOWS\textsuperscript{1,2}

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ABSTRACT

In an effort to determine whether anestrus in swine is due to aberrant ovarian feedback control of gonadotropin release, this study contrasted the influence of ovariectomy on LH concentrations in serum of anestrous sows and in sows that returned to estrus following weaning. Blood samples were collected at 6-h intervals from 7 d prior to until 4 d after ovariectomy of 22 anestrous and 24 cyclic sows. Blood samples also were collected at 15-min intervals for 8 h at 2 d prior to and 2 d after ovariectomy. Sampling at 6-h intervals continued until 12 d after ovariectomy and additional 8-h windows of 15-min samples were taken at 7 and 12 d after ovariectomy of seven anestrous and nine diestrous sows. Mean LH concentrations and LH pulse frequencies were greater (\textit{P} < .05) 2 d after ovariectomy than 2 d prior to ovariectomy in both anestrous and diestrous sows. Mean pulse amplitude had increased by 2 d after ovariectomy in anestrous sows but did not change in cyclic sows. Baselines as determined from the mean of all LH measurements excluding pulses, remained the same in both anestrous and diestrous sows at 2 d after ovariectomy. Pulse frequency, pulse amplitude, and mean LH concentration were greater (\textit{P} < .05) in both anestrous and diestrous sows at 7 and 12 d after ovariectomy than at 2 d prior to and 2 d after ovariectomy. Pulse amplitude on d 7 and 12 after ovariectomy decreased (\textit{P} < .05) in both anestrous and diestrous sows relative to those observed at earlier times. Anestrous and cyclic sows had similar LH responses to ovariectomy. Results support the hypothesis that the ovaries contribute to LH suppression in the anestrous sow. (Key Words: Sows, Anestrous, Ovariectomy, LH.)

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Introduction

At present, the endocrine physiology of postweaning anestrus in sows is poorly understood; however, whereas estrogen and LH concentrations increase after weaning in sows destined to become anestrous (Armstrong et al., 1986), preovulatory discharges of LH fail to occur. In sows returning to estrus following weaning, there is increased pulsatile secretion of LH, a rapid increase in follicle size and concomitant increased production of estrogens culminating in a preovulatory surge of LH, estrus and ovulation (Stevenson et al., 1981; Cox and Britt, 1982). The components of the hypothalamic-hypophysal-ovarian axis appear to be functional in anestrous sows because
treatment with exogenous gonadotropins, pulses of GnRH, or estradiol induce estrus and ovulation in the anestrous sow (Dial et al., 1984; Armstrong and Britt, 1985).

Inhibitory influences on LH secretion are removed by ovariotomy of prepubertal and post pubertal gilts (Fonda et al., 1983; Berardi-nelli et al., 1984). Whereas ovariotomy of diestrous sows increases LH concentrations (Parvizi et al., 1976), LH concentrations in lactating sows do not change following ovariotomy (Stevenson et al., 1981). The effects of ovariotomy on pulsatile or basal LH secretion in the anestrous sow presently are poorly understood. In an effort to determine whether there is an altered responsiveness of the hypothalmo-hypophyseal axis of the anestrous sow to ovarian secretions, these studies related LH secretion prior to and after ovariotomy of long-term anestrous sows with that of sows that resumed ovarian activity normally following weaning.

**Materials and Methods**

**Animal Management.** Twenty-two anestrous sows that had not exhibited estrus by 45 d postweaning and 24 cyclic sows that had resumed normal estrous cyclicity within 7 d following weaning were purchased from a commercial swine farm. The animals had lactated for approximately 3 wk. Sows obtained from the farm during July to October 1986 were delivered to animal holding facilities at North Carolina State University.

All sows were nonsurgically fitted with indwelling jugular vein cannulas upon arrival. Sows were housed in crates and fed daily 2.5 to 3.0 kg of a corn-soybean diet designed to meet or exceed daily nutritional requirements (NRC, 1983). Ambient temperature was maintained at approximately 23°C in environment-controlled, light-tight rooms. The photoperiod was maintained at 14 h light:10 h dark.

The ovarian status of each sow was classified at the time of ovariotomy. Examination of the ovaries from anestrous sows revealed follicles <5 mm in diameter and corpora albicantia <2 mm in diameter, but no corpora lutea. Based on ovarian status and ovarian steroid concentrations, cyclic sows were further divided into two groups: diestrous sows under progesterone (P4) influence (n = 18, P4 > 1.0 ng/ml, estradiol-17 beta (E2) < 10 pg/ml) with corpora lutea on the ovaries and periestrous sows predominately under E2 influence (n = 6, P4 < .3 ng/ml, E2 > 10 pg/ml for 48 h prior to ovariotomy) with large follicles and regressing corpora lutea.

Blood samples were collected at 6-h intervals for 7 d prior to and 4 d after ovariotomy for all sows. At 2 d prior to and 2 d after ovariotomy, blood samples were collected at 15-min intervals for 8 h from all 46 sows. The 6-h interval sampling was continued until 12 d after ovariotomy in seven anestrous and nine diestrous sows. Additional 8-h windows of 15-min samples were taken from these 16 animals at 7 and 12 d after ovariotomy. Blood was allowed to clot at room temperature prior to centrifugation to harvest serum. Serum samples were frozen at -20°C until RIA for LH concentrations.

Luteinizing hormone concentrations were determined in all serum samples, and E2 and P2 concentrations were determined in daily samples, collected from 7 d before to 4 d after ovariotomy.

**Radioimmunoassay of LH.** All serum samples were assayed for LH concentrations using a previously established double antibody RIA (Dial et al., 1983). Each sample was assayed in duplicate 200-μl aliquots, and results were expressed in terms of purified porcine reference standard LER 786-3. The coefficient of variation (CV) of replicate measurements of each sample consistently was less than 5%. The intra-assay CV for both low (1.8 ng/ml) and high (9.5 ng/ml) LH reference sera were less than 5%, and the interassay CV for the LH RIA (n = 38 assays) were 8.1% and 11.0% for the low and high sera, respectively. Sensitivity of the assay, expressed as the lowest weight of hormone different from tubes containing phosphate-buffered saline (PBS) without LH, was 50 pg/tube.

**Radioimmunoassay of E2.** A previously established single antibody, charcoal dextran RIA was used to quantitate serum concentrations of E2 (Cox et al., 1987). Serum samples of 600 μl were extracted with anesthetic ether, reconstituted with 600 μl of .1% gelatin PBS and subsequently assayed in duplicate 200-μl aliquots. Niswender’s No. 244 antisemum was used in a final dilution of 1:370,000. Each assay tube received 100 μl of the final dilution of antisemur. Approximately 10,000 cpm (100 μl) of estradiol-6-(o-carboxymethyl)-oximino-(2-[125I])4, previously diluted to provide a working solution of 100,000 cpm/ml,
was added to each tube. The CV of replicate measurements of samples consistently was <5%. The intra-assay CV for the \( E_2 \) RIA (n = 8 assays) for the low (25 pg/ml) and high (165 pg/ml) reference sera were less than 5%. Interassay CV were 4.8% and 8% for the high and low sera, respectively. Sensitivity of the \( E_2 \) RIA, estimated by adding various amounts of \( E_2 \) to serum, was approximately 0.2 pg/tube.

Radioimmunoassay of Progesterone. A single-antibody, charcoal-dextran RIA using Gordon-Sherwood antiserum No. 253 in a final dilution of 1:300,000 was used to determine \( P_4 \) concentrations. Serum aliquots of 100 \( \mu l \) initially were diluted with 900 \( \mu l \) of PBS-gelatin. Duplicate 40-\( \mu l \) aliquots of the initial solution then were diluted further with 460 \( \mu l \) PBS-gelatin. Radioiodinated \( P_4 \) was diluted with PBS-gelatin to provide a working solution of 10,000 cpm/ml. Approximately 10,000 cpm (100 \( \mu l \)) of the working solution of the ligand was added to each tube, followed by incubation at 4°C for 24 h. Separation of bound from free steroid was accomplished using dextran-coated charcoal. Serum samples were reasayed if the CV of replicate measurements exceeded 10%. Interassay CV for the reference sera were 8.1% (8 ng/ml), 7.0% (16 ng/ml) and 5.5% (32 ng/ml). Intra-assay CV for the reference sera were consistently less than 5%. Sensitivity of the \( P_4 \) RIA (n = 7 assays), estimated from varying weights of \( P_4 \) added to sera from a long-term ovariectomized sow, was approximately 5 pg/tube.

Data Analysis. Serum concentrations of LH in samples collected at 15-min intervals for 8 h were used to characterize pulsatile LH secretion (Goodman and Karsch, 1980). A pulse of LH was defined as a transient elevation of LH concentrations that was at least 1 SD over baseline. Baselines were computed as means of all LH measurements, excluding the pulses of LH release. The difference between the maximum LH concentration in a pulse and the baseline was considered the pulse amplitude. Mean LH concentration for the 8-h sampling period was the mean of the 33 samples collected at 15-min intervals. In this manner, mean LH concentration, baselines, and frequency and amplitude of pulses were determined for each sow for each 8-h sampling period.

The LH pulse characteristics of the 22 anestrous sows and 18 diestrous sows were analyzed by split-plot analyses of variance for repeated measurements (Gill and Hafs, 1971). The model included sow types (anestrous and diestrous), sow within type (error term for testing type effects), day relative to ovariectomy, and interactions. Mean comparisons were evaluated by a protected least significant difference test (Snedecor and Cochran, 1980). The statistical analysis of the LH pulse data for the seven anestrous and nine diestrous sows was done in a similar fashion. Due to rapidly rising LH concentrations in six periestrous sows prior to ovariectomy, pulsatile LH secretion could not be characterized, and the appropriate data form these sows were omitted in the analysis of pulsatile LH secretion.

Mean (± SE) LH concentrations in sows were determined in samples collected at 6-h intervals. The 11-d experimental period was divided relative to time of ovariectomy into these intervals: -168 to -102 h, -96 to -54 h, -48 to 0 h, 6 to 24 h, 30 to 48 h, 54 to 72 h and 78 to 96 h. Differences in LH concentrations were analyzed by split-plot analyses of variance for repeated measurements with the data blocked for the appropriate intervals (SAS, 1985). Where significant effects were established, differences between means for particular periods were analyzed by a protected least significant difference test (Snedecor and Cochran, 1980). To further characterize the change in LH concentrations following ovariectomy, mean LH concentrations in each group was expressed as a percent relative to serum concentrations collected during the 48-h period prior to ovariectomy.

Results

There was an increase (\( P < .05 \)) in mean and baseline LH concentrations as well as in frequency and amplitude of pulses (\( P < .01 \)) in anestrous sows at 2 d following ovariectomy (Table 1). Similar increases in LH concentrations were observed in diestrous sows, with the exception that amplitude of the LH pulses decreased numerically, but not significantly after ovariectomy.

Mean baseline LH concentrations prior to ovariectomy were lower (\( P < .05 \)) in anestrous sows than in diestrous sows, whereas pulse

\footnote{Amersham Corporation, Arlington Hts., IL.}

\footnote{Cambridge Medical Diagnostics, Billerica, MD.}
amplitude and frequency were similar (Table 1). Both pulse frequency and pulse amplitude and, thus, mean LH at 2 d after ovariectomy, were greater (P < .05) in anestrous than in diestrous sows. Day x sow-type interaction was not detected (P > .1) for any pulse characteristic.

Characteristics of pulsatile LH concentrations in the subset group of seven anestrous sows sampled for 12 d following ovariectomy (Table 2) differed from the results obtained from the entire group of sows sampled at 2 d after ovariectomy (Table 1). Mean LH concentrations and pulse frequency and amplitude increased (P < .05) in anestrous sows from 2 d prior to ovariectomy to 2 d after ovariectomy (Table 2): baseline LH tended to increase but the difference was not significant (P > .05). Mean and baseline LH concentrations of anestrous sows did not increase further at either 7 or 12 d above values observed at 2 d after ovariectomy. However, frequency of pulses was greater (P < .05) at 7 and 12 than at 2 d prior to or 2 d after ovariectomy. Amplitude of LH pulses was less (P < .05) at 7 or 12 d than at 2 d postovariectomy and tended to be less (P = .09) than that observed prior to ovariectomy. Mean LH concentrations in samples taken from 6 d prior to until 12 d after 9 ovariectomy revealed that LH concentrations rose abruptly following removal of ovaries and then remained relatively stable throughout the remaining 12-d sampling period (Figure 1). Relative to diestrous sows (Figure 1), LH concentrations in anestrous sows were low prior to ovariectomy and increased within 6 h of ovariectomy to concentrations similar to those following ovariectomy of diestrous sows.

In contrast to the entire group of diestrous sows (Table 1), mean and baseline LH concentrations of the subset group of diestrous sows sampled for 12 d did not increase by 2 d

TABLE 2. PULSATILE PATTERN OF LH* RELEASE PRIOR TO AND AFTER OVARIECTOMY

<table>
<thead>
<tr>
<th>Day relative to ovariectomy</th>
<th>Mean LH, ng/ml</th>
<th>Baseline LH, ng/ml</th>
<th>No. of pulses/8h</th>
<th>Mean amplitude of pulses, ng/ml</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anestrous (n = 7)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 d prior</td>
<td>1.02 ± .11b</td>
<td>.81 ± .11b</td>
<td>2.70 ± .41b</td>
<td>.93 ± .12c</td>
</tr>
<tr>
<td>7 d post</td>
<td>1.71 ± .25c</td>
<td>1.14 ± .20bc</td>
<td>5.73 ± .70c</td>
<td>1.30 ± .10bc</td>
</tr>
<tr>
<td>12 d post</td>
<td>1.31 ± .25bc</td>
<td>1.05 ± .20bc</td>
<td>7.60 ± .70d</td>
<td>.66 ± .10c</td>
</tr>
<tr>
<td>2 d prior</td>
<td>1.63 ± .23c</td>
<td>1.33 ± .19c</td>
<td>7.70 ± .66d</td>
<td>.71 ± .09cd</td>
</tr>
<tr>
<td>7 d post</td>
<td>1.96 ± .10b</td>
<td>.76 ± .10b</td>
<td>3.40 ± .38b</td>
<td>.90 ± .21c</td>
</tr>
<tr>
<td>12 d post</td>
<td>1.26 ± .10bc</td>
<td>.97 ± .10bc</td>
<td>5.30 ± .42c</td>
<td>.76 ± .04cd</td>
</tr>
<tr>
<td>2 d post</td>
<td>1.41 ± .10c</td>
<td>1.24 ± .10c</td>
<td>6.20 ± .42ed</td>
<td>.51 ± .04d</td>
</tr>
<tr>
<td>7 d post</td>
<td>1.60 ± .10c</td>
<td>1.40 ± .10c</td>
<td>6.80 ± .42d</td>
<td>.55 ± .04d</td>
</tr>
</tbody>
</table>

*Least squares means ± SE.

b,c,dNumbers in each column with different superscripts differ (P < .05).
following ovariectomy (Table 2), but by 7 and 12 d these concentrations were greater \( (P < .05) \) than those measured at 2 d prior to ovariectomy. Frequency of LH pulses in diestrous sows was greater \( (P < .05) \) following ovariectomy than prior to ovariectomy, and pulse frequency increased with time after ovariectomy, similar to that in anestrous sows (Table 2). In contrast to pulse frequency, amplitude of LH pulses decreased with time \( (P < .05) \) after ovariectomy in diestrous sows.

Concentrations of LH in samples taken at 6-h intervals from 6 d prior to until 12 d after ovariectomy of diestrous sows showed no evidence of a LH increase following ovariectomy (Figure 1).

Mean LH, baseline and number of pulses did not differ between the seven anestrous and nine diestrous sows on any day after ovariectomy (Table 2). Pulse amplitude of anestrous sows was greater \( (P < .05) \) at 2 d after ovariectomy than at 2 d prior to ovariectomy.

### TABLE 3. MEAN LH RELEASE PRIOR TO AND AFTER OVARIECTOMY

<table>
<thead>
<tr>
<th>Time, h</th>
<th>Anestrous sows (n = 22)</th>
<th>Diestrous sows (n = 18)</th>
<th>Periestrous sows (n = 6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>-168 to 102</td>
<td>0.83 ± 0.04&lt;sup&gt;ef&lt;/sup&gt;</td>
<td>1.70 ± 0.13&lt;sup&gt;g&lt;/sup&gt;</td>
<td>0.85 ± 0.08&lt;sup&gt;ef&lt;/sup&gt;</td>
</tr>
<tr>
<td>-96 to -54</td>
<td>0.79 ± 0.04&lt;sup&gt;ef&lt;/sup&gt;</td>
<td>1.80 ± 0.19&lt;sup&gt;g&lt;/sup&gt;</td>
<td>0.75 ± 0.08&lt;sup&gt;ef&lt;/sup&gt;</td>
</tr>
<tr>
<td>-48 to 0</td>
<td>0.73 ± 0.04&lt;sup&gt;ef&lt;/sup&gt;</td>
<td>1.21 ± 0.07&lt;sup&gt;g&lt;/sup&gt;</td>
<td>1.97 ± 0.37&lt;sup&gt;db&lt;/sup&gt;</td>
</tr>
<tr>
<td>6 to 24</td>
<td>1.58 ± 0.10&lt;sup&gt;af&lt;/sup&gt;</td>
<td>1.73 ± 0.10&lt;sup&gt;f&lt;/sup&gt;</td>
<td>0.86 ± 0.09&lt;sup&gt;ca&lt;/sup&gt;</td>
</tr>
<tr>
<td>30 to 48</td>
<td>1.61 ± 0.01&lt;sup&gt;af&lt;/sup&gt;</td>
<td>1.59 ± 0.09&lt;sup&gt;f&lt;/sup&gt;</td>
<td>0.94 ± 0.11&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>54 to 72</td>
<td>1.68 ± 0.05&lt;sup&gt;af&lt;/sup&gt;</td>
<td>1.67 ± 0.07&lt;sup&gt;f&lt;/sup&gt;</td>
<td>0.87 ± 0.14&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>78 to 96</td>
<td>1.08 ± 0.09&lt;sup&gt;ef&lt;/sup&gt;</td>
<td>1.62 ± 0.08&lt;sup&gt;g&lt;/sup&gt;</td>
<td>0.99 ± 0.14&lt;sup&gt;f&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

<sup>a</sup>Means ± SE.

<sup>b</sup>Hours relative to ovariectomy.

<sup>c,d</sup>Numbers in each column with different superscripts differ \( (P < .05) \).

<sup>e,f</sup>Numbers in each row with different superscripts differ \( (P < .05) \).
and was greater ($P < .05$) than the pulse amplitude of diestrous sows at all times following ovariectomy.

Mean LH concentrations at various time intervals relative to ovariectomy are given in Table 3 for anestrous, diestrous and periestrous sows. Concentrations of LH in anestrous sows prior to ovariectomy were lower ($P < .05$) than LH concentrations in the diestrous sows (Table 3). Mean LH concentrations of anestrous and diestrous sows were similar for the initial 72 h following ovariectomy, at which time LH concentrations in anestrous sows because less than those observed in blood samples taken earlier from anestrous sows and from diestrous sows.

Analysis of data revealed that status of the sow at the time of ovariectomy influenced LH response to ovariectomy. Mean LH concentrations in diestrous sows tended to be the same after ovariectomy as prior to ovariectomy (Table 3). In contrast, LH concentrations in periestrous sows increased during the 48-h interval immediately prior to ovariectomy, reflecting preovulatory LH surges (Figure 2). The LH concentrations in periestrous sows following ovariectomy returned to concentrations similar to those observed prior to initiation of LH surges. Luteinizing hormone concentrations in periestrous sows after ovariectomy were less ($P < .05$) than those of both diestrous sows and anestrous sows.

The percentage change in LH concentrations following ovariectomy relative to the mean LH in samples taken 48 h prior to ovariectomy (Figure 3) revealed that ovariectomy resulted in different effects on LH release.

Figure 2. Mean LH concentrations on 22 anestrous, 18 diestrous and 6 periestrous sows from approximately 6 d prior to and until 4 d after ovariectomy. The SE are indicated by vertical flags.

Figure 3. The percentage change in LH concentrations following ovariectomy relative to mean LH concentrations in samples taken within 48 h of ovariectomy of sows having differing physiologic status. There were 22 anestrous, 18 diestrous and 6 periestrous sows.
among the three sow types. The percentage change in LH concentrations following ovariectomy of anestrous sows tended to be greater than 200%, whereas LH concentrations in the periestrous sows decreased following ovariectomy. Ovariectomy of diestrous sows was followed by an increase in LH concentrations; however, this increase was less than that observed in anestrous sows.

Serum P_4 concentrations were elevated at ovariectomy of diestrous sows, were low at ovariectomy of anestrous sows, and fell within a few days prior to ovariectomy of periestrous sows (Figure 4). Progesterone and E_2 concentrations (Figure 4) in diestrous and periestrous sows declined following ovariectomy. Serum P_4 concentration in diestrous sows decreased from 8.5 ± 2.1 ng/ml at 48 h prior to
ovariectomy to 1.0 ± .3 ng/ml at 24 h after ovariectomy. Concentrations in diestrous sows decreased to .27 ± .07 ng/ml by 4 d after ovariectomy. Periestrous sows had P4 concentrations less than .5 ng/ml prior to ovariectomy, and concentrations decreased to values less than .25 ng/ml after ovariectomy. Serum P4 concentrations in the anestrous sows did not change following ovariectomy; concentrations consistently were less than .25 ng/ml.

Serum E2 concentrations in periestrous sows increased to greater than 25 pg/ml 1 to 3 d prior to ovariectomy (Figure 4) and subsequently declined to less than 5 pg/ml after ovariectomy. Diestrous sows had relatively constant serum E2 concentrations of approximately 20 pg/ml until approximately 4 d prior to ovariectomy, at which time E2 levels began in gradual decrease to less than 9 pg/ml by 48 h prior to ovariectomy. Anestrous sows had E2 levels of 10 to 12 pg/ml prior to ovariectomy. Serum E2 concentrations decreased to less than 5 pg/ml in all sows following ovariectomy.

Discussion

The influence of ovariectomy on serum LH concentrations of the pig has not been well documented. Similar to sows of the present study, pulse frequency, pulses amplitude, baseline LH and mean LH were increased following ovariectomy of prepubertal gilts (Fonda et al., 1983). Luteinizing hormone responses to ovariectomy were abrupt, with increases in pulse characteristics being observed by 2 d in the sows of the present study and by 1 d in the prepubertal gilt (Fonda et al., 1983). Mean LH concentrations and characteristics of pulsatile LH release did not change during the initial 2 wk following ovariectomy of the sows in the present study or during a 2- or 3-wk period in the prepubertal gilt (Fonda et al., 1984). These findings contrast with those of an earlier study in which mean LH concentrations increased from approximately 1 wk to 2 wk after ovariectomy of diestrous miniature swine and then continued to steadily increase until greater than 1 mo after ovariectomy (Parvizi et al., 1976).

The influence of reproductive status on response to ovariectomy has been observed previously (Parvizi et al., 1976). In the current study, anestrous sows showed the greatest percentage increase of all sow types in mean LH concentrations during the initial 4 d after ovariectomy. Diestrous sows had a modest increase, whereas periestrous sows had decreased LH concentrations.

Whereas LH concentrations were lower prior to ovariectomy in anestrous sows than in diestrous sows, the characteristics of the postcastration rise in LH concentrations and the pulsatile pattern of LH release were greater in anestrous sows than in diestrous sows at 2 d after ovariectomy. These results indicate that ovarian inhibition of LH release is greater in anestrous sows than in diestrous sows. Baseline LH concentrations and LH pulse frequency and amplitude were similar in diestrous sows and anestrous sows at 7 and 12 d after ovariectomy. Thus, it can be concluded that potential differences in ovarian inhibition in anestrous sows and diestrous sows manifest as varying LH response to ovariectomy for a brief period.

These differences in LH concentrations after ovariectomy may reflect the ovarian steroid concentrations prior to ovariectomy. Both E2 and P4 suppress tonic LH release in the rat (Goodman, 1978) and in the sheep (Goodman and Karsch, 1980; Goodman et al., 1981). Putatively, P4 inhibits LH secretion by suppressing tonic release, whereas E2 inhibits LH release by decreasing pulse amplitude. Perhaps the relatively low LH concentrations observed prior to ovariectomy of anestrous sows were in response to the moderate elevations in circulating E2 concentrations (15 pg/ml). Ovariectomy resulted in removal of that inhibition and subsequently increased LH release. If the influence of E2 on pulse amplitude exists in the sow, as has been suggested for the ewe, it can be postulated that the exaggerated increase in pulse amplitude at 2 d after ovariectomy is in response to abrupt removal of E2 inhibition. Progesterone and E2 have a synergistic influence on pulsatile LH release in the ewe (Goodman et al., 1981; Martin et al., 1983). The LH response of diestrous sows to ovariectomy may have been due to removal of P4, E2, or the combination. The decrease in mean LH concentrations following ovariectomy of periestrous sows could have been due to a depletion of pituitary stores of LH, because all sows had a preovulatory discharge of LH prior to ovariectomy.

The hypothalamus has been proposed as the primary site of action of estradiol in eliciting a LH surge in gilts (Britt et al., 1987). Furthermore, LH pulse frequency ultimately is con-
trolled by GnRH pulse frequency (Armstrong and Britt, 1985). Ovariectomy must alter hypothalamic control of LH release because LH pulse frequency increased in anestrous and diestrous sows following ovariectomy. The present results indicate that the hypothalamus is a site of action for E2 and P4 in diestrous sows and for E2 in anestrous sows.

Evidently, the ovary has the potential to suppress both the pituitary gland and the hypothalamus in the anestrous sow. Because changes in P4 concentrations were not detected after ovariectomy, the role of P4 in LH suppression was not determined in anestrous sows. In contrast, LH concentrations increased concurrently with decreased E2 concentrations after ovariectomy. Therefore, LH suppression in anestrous sows is likely, at least in part, due to the negative feedback effects of E2. Although the ovaries remain acyclic in anestrous sows, it can be concluded that ovarian feedback on the hypothalamic-hypophyseal axis contributes to suppression of LH. Due to limitations of this study, the influence of ovarian feedback at weaning was not determined.

Implications

Ovarian inhibitions of LH is greater in anestrous sows than in diestrous sows, as indicated by lower LH prior to ovariectomy and relatively greater LH after ovariectomy. Despite limited follicular development and absence of corpora lutea, the ovary of the anestrous sow exerts negative feedback on the pituitary gland and hypothalamus. Presumably, this negative feedback precludes the ability of the anestrous sow to initiate estrous cyclicity and, thus the sow remains anestrous.

Literature Cited


