ENDOCRINE CHANGES IN SOWS IN RESPONSE TO ALTERED SUCKLING AND BOAR EXPOSURE

E.A. Newton, J.S. Stevenson, J.E. Minton and D.L. Davis

Summary

Eighteen sows were treated as follows: 1) 10 multiparous and four primiparous sows were separated from their litters for 6 hr/day and exposed to a mature boar for 1 hr/day during the last 8 days of lactation, and 2) four sows (two multiparous and two primiparous) served as untreated controls during lactation. Blood was collected from sows during treatment and after weaning, and various hormones were measured. Altered suckling induced higher concentrations of luteinizing hormone (LH) that caused multiparous sows to show estrus (10/10) during lactation. Younger treated sows had similar increases in LH, but had higher follicle-stimulating hormone (FSH) and no increase in estradiol during treatment as observed in older sows, suggesting a lack of available follicles to be stimulated by the changing LH secretion. Treated sows also had increased cortisol on the first day and increased progesterone on the second day of treatment compared with controls. No differences were observed for concentrations of insulin and thyroxine between treatment groups. Similar hormonal changes occurred in control sows after weaning as in treated sows that showed estrus during lactation. Altered suckling and weaning appear to stimulate similar changes in hormonal secretion before estrus.

Introduction

We have reported previously that estrus can be induced in sows during lactation by reducing the number of nursing pigs prior to weaning (reduced litter size or split weaning; 1983 KSU Swine Day, Report of Progress 442, pp 23-25) or by separating sows from their litters for 3, 6 or 12 hr/day during the last 8 days of lactation (3 to 4 wk in duration), while exposing sows to a mature boar for 1 hr during litter separation (1984 KSU Swine Day, Report of Progress 461, pp 15-18). We have observed that 45% of the first-litter sows and 76% of the older sows separated from their litters and exposed to a boar (altered suckling) express estrus in 4 to 8 days. By studying lactational estrus in sows, we hope to determine how suckling prevents estrus and why fewer primiparous sows show estrus during lactation. This information may lead to development of methods to minimize occurrence of anestrus after weaning and improve fertility. Our objective in this study was to examine the effect of altered suckling and parity on hormonal changes associated with the estrus induced during lactation by altered suckling as well as the postweaning estrus in control sows.

Procedures

We utilized 18 crossbred sows and assigned them to two treatment groups: 1) treated multiparous (TM) sows (n=10) and treated primiparous (TP) sows (n=4) were separated from their litters for 8 hr during the last 8 days of lactation (duration of lactation = 26 days), and 2) control multiparous (CM, n=2) and control primiparous (CP, n=2) were untreated and not exposed to boars until after weaning. Indwelling catheters were inserted nonsurgically into the vena cava to allow blood to be collected for 5 days (-1, 0, 1, 2, and 3) at 20-min intervals from 1200 to 1700 h on each day. Sampling began 2 hr after litter separation and boar exposure (day 0) and continued 1 hr after sows were reunited with piglets. Those sows not detected in estrus were subjected to a similar sampling regimen on days -1, 0, 1, and 2 from weaning (day 0). Serum was analyzed in all samples (16/day) for concentrations of FSH and LH. Six hourly samples/day were analyzed for insulin and thyroxine, and a pooled sample for each day was assayed for progesterone, estradiol-17ß, and cortisol. All analyses were made by radioimmunoassays, validated in our laboratory.

Results and Discussion

The estrous response of all sows during lactation and after weaning is summarized in Table 1. All of the treated multiparous (TM) sows (10/10) exhibited estrus during lactation, whereas none of the treated primiparous (TP) sows (0/4), control multiparous (CM) sows (0/2), or control primiparous (CP) sows (0/2) returned to estrus until after weaning. Intervals to estrus for the TP, CP, and CM sows after weaning were of similar duration and resembled those observed in the TM sows during lactation. These results are similar to our previous findings except that no primiparous (TP or first-litter) sows came into heat during lactation in response to treatment. This is the first time, however, that we have attempted these treatments during spring or summer. This study was conducted in May, whereas previous studies were during fall and winter months. We have since conducted a similar study in August (1985) and observed no sows, either multiparous or primiparous sows, in heat during lactation. It appears, therefore, that the altered-suckling response may be a seasonal response.

Table 1. Characteristics of Estrus after Altered Suckling and Weaning.

Item	Treatment group[a]				SE[b]
	CM	TM	CP	TP	
No. sows	2	10	2	4	
No. sows in estrus during lactation	0	10	0	0	
Days to estrus after treatment		5.2			0.5
Days to estrus after weaning	3.0		4.0	5.0	0.5

[a]CM = Control multiparous, TM = treated multiparous, CP = control primiparous, and TP = treated primiparous sows.
[b]Standard error of the mean.

Changes in concentrations of the gonadotropins, LH and FSH, during treatment (lactation) are summarized in Fig. 1. Younger (TP and CP) sows had higher concentrations of FSH than older sows before and during treatment. Altered suckling did not alter concentrations of FSH. Levels of LH were increased markedly in treated (TM and TP) sows in response to litter separation and boar exposure. Other characteristics of LH patterns (LH pulse frequency and pulse amplitude) were higher in TP sows, even though they failed to show estrus. The changes in gonadotropins that resulted in lactational estrus for TM sows are shown in Fig. 1. This ratio of gonadotropins appears to be important to induce estrus and ovulation during lactation.

Another prerequisite for lactational estrus is the availability of developing ovarian follicles capable of being stimulated by the treatment-induced change in gonadotropins. Older sows had higher estradiol-17ß (which indicates greater follicular growth) in serum than younger sows before treatment began (Fig. 2). Changes in LH secretion must have induced follicular maturation, as evidenced by increasing concentrations of estradiol-17ß in TM sows and the resulting estrus during lactation. Treated (TM and TP) sows had higher levels of progesterone and cortisol (Fig. 2) than control (CM and CP) sows. No differences were observed because of treatment in patterns of thyroxine and insulin (data not shown).

Although TP sows had increased concentrations of LH and increased LH pulse frequency and amplitude, they failed to express estrus during lactation. As shown in Fig. 2, TP and TM sows also had higher concentrations of cortisol, which were probably related to the stress of increased movement, exposure to unfamiliar pens, and encounters with other sows and boars during treatment. This possible stress failed to inhibit estrus in the TM sows during lactation but perhaps TP sows failed to come into estrus because they are more sensitive to stress. In addition, concentrations of progesterone also were increased by altered suckling on the second day (day 1; Fig. 2) of treatment. However, this increase may have resulted from an increased LH pulse frequency and follicular secretion of progesterone rather than a response to stress, because its increase did not occur on the first day of treatment as was observed for cortisol.

These data might indicate that TP sows failed to show heat during lactation because of increased cortisol and progesterone during treatment. Alternatively, we know from previous studies that older sows have considerable follicular growth on their ovaries during lactation compared with first-litter sows. Therefore, the TP sows may have failed to respond because they lacked follicles capable of responding to increased LH secretion that led to estrus and ovulation in TM sows. Further work will help us better understand the mechanisms of hormonal secretion and estrous expression after altered suckling. We observed that the hormonal changes in sows that show estrus during lactation are very similar to what occurs in sows after conventional weaning (data not shown). Therefore, reducing or altering suckling patterns and providing exposure to boars seem to be adequate stimuli in older sows to result in estrus similar to that occurring after conventional weaning. We believe that further studies examining the response to altered suckling and boar exposure during lactation will give greater insight into approaches to improve fertility and reduce the occurrence of anestrus in sows.

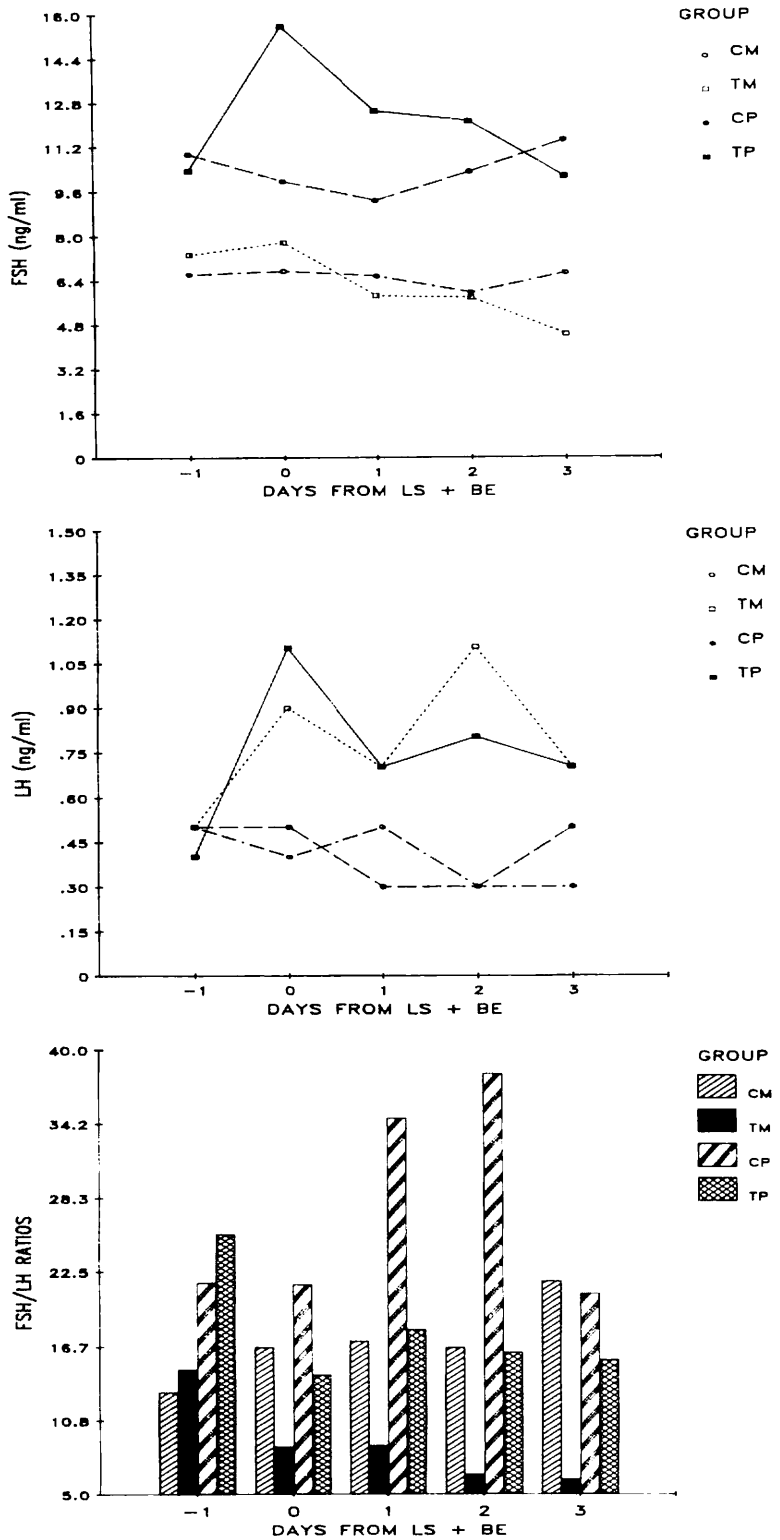

Fig. 1. Mean concentrations of FSH and LH in serum (avg. of 16 samples/day) and FSH and LH ratios in 4 treated primiparous (TP), 10 treated multiparous (TM), 2 control primiparous (CP), and 2 control multiparous (CM) sows from litter separation and boar exposure (LS + BE).

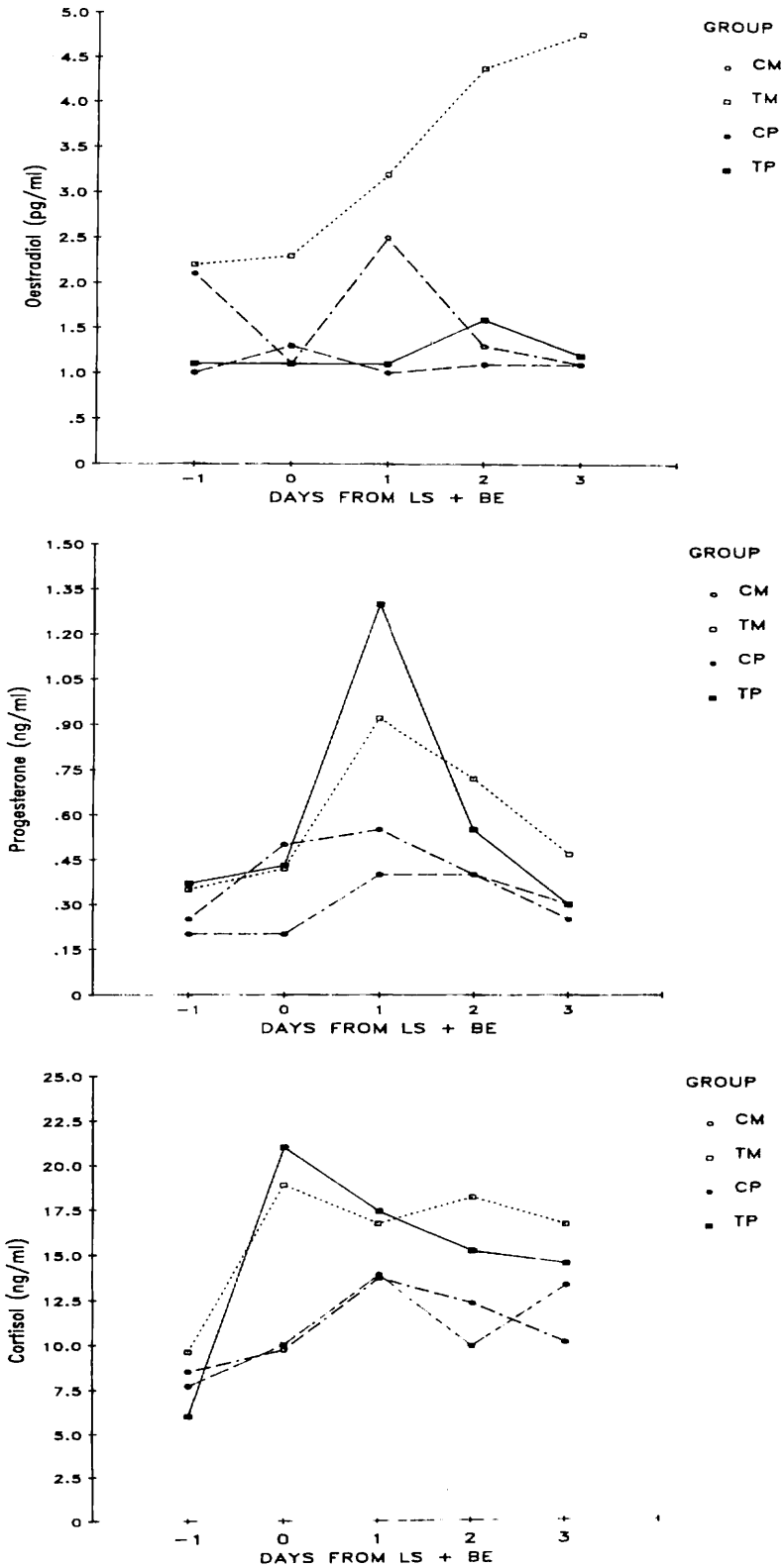

Fig. 2. Mean concentrations of oestradiol, progesterone, and cortisol in 4 treated primiparous (TP), 10 treated multiparous (TM), 2 control primiparous (CP), and 2 control multiparous (CM) sows from litter separation and boar exposure (LS + BE).