EFFECT OF EXOGENOUS GONADOTROPINS ON THE WEANING-TO-ESTRUS INTERVAL IN SOWS

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ABSTRACT

The efficacy of PG 600 (400 IU PMSG and 200 IU hCG) for accelerating the onset of estrus was determined for sows weaned during the summer. Yorkshire sows (average parity = 4.6), nursing 8.6 ± 0.2 pigs (mean ± SEM) were weaned after 27.7 ± 0.4 d of lactation and were treated intramuscularly with either PG 600 (n = 35) or with 0.9% saline (n = 35). Sows were checked for estrus once daily in the presence of a mature boar. Treatment with PG 600 increased (P < 0.05) the percentage of sows in estrus within 7 d after weaning (97.1 vs 82.9%). Relative to controls, sows given PG 600 expressed estrus sooner (3.8 ± 0.1 d vs 4.5 ± 0.1 d; P < 0.01). Sows exhibiting estrus within 7 d after treatments were artificially inseminated 0 and 24 h after first exhibiting estrus. The percentage of inseminated sows that farrowed tended to be higher (P < 0.07) for control than for PG 600-treated sows (96.6 vs 82.3%). The number of pigs born live was similar (P > 0.1) for sows treated with PG 600 and with saline, and was 17.7 ± 0.6 and 11.7 ± 0.7, respectively. Pigs farrowed by saline-treated sows, however, tended to be heavier (P < 0.09) than pigs farrowed by sows treated with PG 600 (1.49 ± 0.06 kg vs 1.34 ± 0.06 kg). In summary, PG 600 accelerated the onset of estrus in sows weaned during the summer. Sows mated during the induced estrus, however, tended to have a lower farrowing rate and farrowed lighter pigs than control sows inseminated during a natural estrus occurring within 7 d after weaning.

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Key words: gonadotropins, estrus, sows

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INTRODUCTION

Nonproductive days accumulate for sows that are not pregnant or are lactating, and include the period between weaning and first service. Industry records indicate that nonproductive days are the most important factor in determining herd rank at the top or bottom of a productivity group (10). Thus, to enhance reproductive efficiency in the breeding herd, the number of such days needs to be minimized.

During lactation in the sow, there is a suckling-induced suppression of LH and FSH secretion (5). Removal of pigs at weaning allows for increased gonadotropin secretion which stimulates follicular growth and estradiol secretion, thereby occasioning estrus and ovulation. Sows in good body condition and weaned after a 21- to 28-d lactation period usually return to estrus within 7 d. During periods of high ambient temperature, however, the return to estrus after weaning is often delayed (6,7), presumably due to a dearth of gonadotropin secretion.

The PG 600 compound is a combination of PMSG and hCG. When administered to swine, PMSG and hCG mimic the actions of FSH and LH. Thus, PG 600 has been used to accelerate the onset of estrus in weaned sows.

In a trial conducted on 8 commercial farms during the summer, Bates et al. (4) demonstrated that administration of PG 600 decreased days to estrus in first and second litter sows and lowered the percentage of first litter sows not exhibiting estrus within 10 d after weaning. Sows treated with PG 600, however, displayed a reduction in the number of pigs born live per litter and, on some farms, farrowed more dead pigs and had lower farrowing rates.

Numerous factors affect the weaning-to-estrus interval in sows and responsiveness to PG 600 could vary between herds and production systems. Thus, the objective of this study was to determine the effect of PG 600 on the onset of estrus in sows weaned during the summer.

MATERIALS AND METHODS

This study was conducted at the University of Maryland Eastern Shore (UMES) Swine Research and Education Facility in Princess Anne, Maryland, and procedures were approved by the UMES Institutional Animal Care and Use Committee.

Yorkshire sows with an average parity of 4.6 and nursing 8.6 ± 0.2 pigs were utilized. Tenth rib backfat thickness, determined ultrasonically at weaning, averaged 20.9 ± 0.6 mm. The sows were weaned after 27.7 ± 0.4 d of lactation. The study was conducted during the summer (June-September) and daily high temperature averaged 27°C.

Sows were maintained on a totally-slatted concrete floor in a curtain-sided building that

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5Lean-Meater, Renco Corporation, Minneapolis, MN.
was passively ventilated. From weaning to Day 30 post mating, the sows were individually penned in gestation stalls (2.0 x 0.6 m). On Day 30 of gestation, the sows were moved to a group pen (2.0 m² floor space/sow) served by a computerized feeding system which allowed individual feeding of animals. Sows were moved to standard farrowing crates (2.0 x 1.5 m) in a mechanically ventilated building at approximately 112 d of gestation. All pen types were served by either drip or sprinkler water cooling systems that were activated at 24°C.

Following weaning, sows received 2.25 kg of a commercially prepared ration (14% crude protein) daily. During the last 21 d of gestation the amount of feed allowed was increased to 3.6 kg daily. Sows had access to water ad libitum at all times. Diseases for which sows were vaccinated included leptospirosis, erysipelas and parvovirus.

Experimental Design

At weaning, sows were treated intramuscularly with 5 ml PG 600 (n = 35) or 0.9% saline solution (n = 35). The sows were checked for estrus at 24-h intervals in the presence of a mature boar. Those sows exhibiting estrus within 7 d after weaning were classified as responders. These sows were inseminated with semen of Yorkshire, Landrace or Poland China boars. The sows were inseminated at 0 and 24 h after first exhibiting standing estrus, and each insemination dose contained at least 4 x 10⁹ motile spermatozoa.

Litter characteristics and days to estrus were analyzed using ANOVA. The percentage of sows responding to treatment and farrowing rates were compared using Chi-squares analyses.

RESULTS

Reproduction in sows treated with PG 600 and control sows is summarized in Table 1. Treatment with PG 600 increased (P < 0.05) the percentage of sows in estrus within 7 d after weaning. For the responding animals, the sows treated with PG 600 expressed estrus sooner than the controls (P < 0.01).

The percentage of inseminated sows that farrowed tended to be higher (P < 0.07) for control sows than for PG 600-treated sows. Litter characteristics for sows treated with PG 600 or 0.9% saline appear in Table 2.

DISCUSSION

Britt (5) described the endocrinology of the lactating sow. Between postpartum days 14 and 21, secretion of LH and FSH increases. This increased secretion continues until

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Clay Equipment Co., Cedar Falls, IA.

Southern States, Baltimore, MD.
Table 1. Reproduction in sows following treatment with PG 600 or 0.9% saline (controls) at weaning.

<table>
<thead>
<tr>
<th>Item</th>
<th>PG 600</th>
<th>Control</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sows in estrus within 7 d after weaning</td>
<td>97.1%</td>
<td>82.9%</td>
<td>&lt; 0.05</td>
</tr>
<tr>
<td></td>
<td>(34/35)</td>
<td>(29/35)</td>
<td></td>
</tr>
<tr>
<td>Treatment to estrus (d)</td>
<td>3.8 ± 0.1</td>
<td>4.5 ± 0.1</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td></td>
<td>(34/35)</td>
<td>(29/35)</td>
<td></td>
</tr>
<tr>
<td>Inseminated sows that farrowed</td>
<td>82.3%</td>
<td>96.6%</td>
<td>&lt; 0.07</td>
</tr>
<tr>
<td></td>
<td>(28/34)</td>
<td>(28/29)</td>
<td></td>
</tr>
</tbody>
</table>

Values are mean ± SE for sows that displayed estrus within 7 d after treatments.

Table 2. Litter characteristics (mean ± standard error of the mean) for sows farrowing following treatment with PG 600 or 0.9% saline (controls) at weaning.

<table>
<thead>
<tr>
<th>Item</th>
<th>PG 600</th>
<th>Control</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number farrowing</td>
<td>28</td>
<td>28</td>
<td>---</td>
</tr>
<tr>
<td>Total Litter Size</td>
<td>13.5 ± 0.7</td>
<td>12.2 ± 0.7</td>
<td>&gt; 0.1</td>
</tr>
<tr>
<td>Pigs Born Alive</td>
<td>12.1 ± 0.6</td>
<td>11.7 ± 0.7</td>
<td>&gt; 0.1</td>
</tr>
<tr>
<td>Pigs Born Dead</td>
<td>0.4 ± 0.1</td>
<td>0.3 ± 0.1</td>
<td>&gt; 0.1</td>
</tr>
<tr>
<td>Mummified Fetuses</td>
<td>0.4 ± 0.1</td>
<td>0.2 ± 0.1</td>
<td>&gt; 0.1</td>
</tr>
<tr>
<td>Pig Birth Weight (kg)</td>
<td>1.34 ± 0.06</td>
<td>1.49 ± 0.06</td>
<td>&lt; 0.09</td>
</tr>
</tbody>
</table>

Weaning, which allows a further increase in gonadotropin release. Rapid follicular growth ensues, and there is an associated rise in circulating levels of estradiol. Estradiol is responsible for the behavioral changes associated with estrus and elicits the gonadotropin surge, resulting in ovulation.

Sows in good body condition and weaned at or after Day 21 of lactation usually return to estrus within 7 d. Aberrant reproduction, however, has been reported for some sows, particularly those weaned during hot weather. For example, Cox et al. (7) reported that the weaning-to-estrus interval for sows raised at commercial farms in North Carolina during the summer was 8 d longer than for sows weaned during the winter.

The delayed return to estrus in the heat-stressed sow is probably a manifestation of a perturbed hypothalamic-pituitary axis. Hypothalamic concentrations of GnRH and pituitary concentrations of LH were lower in sows weaned during the summer compared with those in sows weaned during the winter (2). Serum concentrations of LH were suppressed in anestrous sows that were weaned during the summer (1). Moreover, pulsatile secretion of LH was decreased in sows housed in an environmental chamber maintained at 30°C compared with that of control sows maintained at 22°C (3).
Treatment with PG 600 mimics the increase in LH and FSH secretion that normally occurs after weaning in late lactation. In our current investigation, PG 600 accelerated the onset of estrus in weaned sows. These results are consistent with a previous study (4) in which PG 600, administered to sows after lactation periods of 21 to 28 d, decreased the number of days to estrus for first and second litter females, and increased the percentage of first litter sows exhibiting estrus within 10 d after weaning.

Sows inseminated after PG 600 treatment tended to have a lower farrowing rate than control animals. Similarly, Bates et al. (4) reported that on 2 of 8 farms, PG 600-treated sows had lower farrowing rates than the controls. Sows on one of these farms had displayed clinical signs of leptospirosis, and it was suggested that females infected with reproductive diseases may not respond favorably to PG 600 and if treated with the compound may exhibit further declines in reproductive performance. It is doubtful that the lower farrowing rate exhibited by PG 600-treated sows in the current investigation was related to compromised herd health. The sows had not shown any clinical signs of reproductive diseases and were vaccinated against leptospirosis, parvovirus and erysipelas. Additionally, the sows had no titers for antibodies against pseudorabies (D.T. Noble, personal communication).

Bates et al. (4) reported that sows treated with PG 600 had fewer pigs born live than control sows. Moreover, in that study, the herd in which clinical signs of leptospirosis were observed had significantly more dead pigs farrowed by sows that had been treated with PG 600.

Our sample size did not provide us with the power to detect statistically significant differences in total litter size, pigs born live or dead, or mummified fetuses between PG 600-treated and control sows. However, when comparing means, total litter size (by 1.3 pigs/litter) and pigs born live (by 1 pig/litter) were greater for PG 600-treated sows than for the controls. Consistent with larger litter sizes, pigs farrowed by PG 600-treated sows tended to be smaller than those farrowed by control animals. Similarly, in a study by Tonn et al. (11), PG 600 increased the number of conceptuses recovered at surgery 11.5 d after the onset of estrus in sows weaned at 5 to 11 d or 23 to 31 d postpartum.

Thus, in our study, farrowing rates were suppressed but litter size was probably enhanced by PG 600 treatment. Perhaps these equivocal results are related to the number of ovulations in PG 600-treated sows. Similar to a previous study (9), work in our laboratory (M.J. Estienne and T.G. Hartsock, unpublished data) has demonstrated that in PG 600 treated gilts, the ovulation rate is quite variable, ranging from 1 to 33.

Perhaps in our herd, weaned sows that responded to PG 600 by displaying estrus within 7 d could be divided into 2 subpopulations based on ovulation rate. In one, larger group, sows had a normal or even above normal ovulation rate, which would account for the apparent increase in litter size that was seen in PG 600-treated sows in our study. In the other, small group of sows, ovulation rate in response to PG 600 was low, which would partially explain the lower farrowing rate in PG 600-treated sows. If very few oocytes are ovulated, the likelihood of having the more than 4 embryos present in the uterus that are necessary for maintenance of early pregnancy (8) is minimized.
In summary, PG 600 accelerated the onset of estrus and tended to decrease farrowing rates in weaned sows. There was some indication that litter size was increased by PG 600 treatment. Based on this study and previous reports (4,11), as well as on field observations (M.J. Estienne, personal observation), it is apparent that the effects of PG 600 on reproduction in weaned sows vary considerably among herds. More research using larger numbers of weaned sows is needed to address the issue of ovulation rate after PG 600 treatment and to determine factors which affect responsiveness to exogenous gonadotropins.

REFERENCES