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Influence of lactation length and gonadotrophins administered at weaning on fertility of primiparous sows

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ABSTRACT

The aim of this study was to determine the effect of lactation length and treatment with gonadotrophins at weaning on reproductive performance of primiparous sows. After 3 wk of lactation, primiparous sows were either weaned (W3; $n=273$) or received a 7-d-old foster litter for a further 14 d of suckling (W5; $n=199$). At final weaning (3 wk or 5 wk lactation) sows were randomly assigned to receive an injection of 400 IU equine chorionic gonadotrophin plus 200 IU human chorionic gonadotrophin (PG600®; W3 + P; $n=108$ and W5 + P; $n=96$) or no injection (W3; $n=165$ and W5; $n=103$). Sows were inseminated at first observed estrus after final weaning and 24 h later. The proportion of sows showing estrus by 6 d post-weaning was greater ($P<0.01$) for W3 + P (86%) compared to W3 (64%), however, there was not a difference ($P=0.13$) for W5 + P (79.4%) compared to W5 (69.1%). There was no effect of either lactation length or gonadotrophin treatment on farrowing rates or on the proportion of sows culled before breeding. Total born litter size was smaller ($P=0.05$) for W3 + P (11.7 ± 0.4) compared to W3 (12.6 ± 0.3). However, sows that lactated for 35 d had larger litters than sows that lactated for 21 d regardless of gonadotrophin treatment (14 ± 0.5 and 14.5 ± 0.4 for W5 + P and W5, respectively; $P<0.001$). These data indicate that for primiparous sows, a longer lactation improves total born litter size at their next farrowing. Gonadotrophin treatment is useful in shortening the weaning to estrus interval but subsequent total born litter size may be negatively affected.

1. Introduction

The number of weaned pigs produced by a farm depends on both mean litter size and number of litters but is driven primarily by ensuring sufficient sows are bred to minimize the risk of empty farrowing pens, i.e., meeting the breeding target (Dial et al., 1996). Variability in the weaning-to-estrus interval (WEI) influences the ability to meet the breeding target, with primiparous sows being particularly prone to having longer and more variable WEI due to inadequate lactation nutrient intake and consequent impaired metabolic status at weaning. This is likely to be accentuated by current production practice of using hyper-prolific sows. There is a limit to the total number of piglets that a sow can raise uniformly with an acceptable piglet survival and weaning weight. The number of teats and milk

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production both constrain piglet growth and survival. Sow milk yields peak at about 15 d and then remain relatively stable until 4 wk, and then decline (Hansen et al., 2012; Toner et al., 1996). Therefore, beyond 3 wk, if daily nutrient intake is increased while the metabolic demands of lactation are stable or decreasing, the net metabolic status of the sow at weaning will be improved with potential benefits to subsequent farrowing rate and litter size. Hence, in systems employing relatively short lactation lengths, nurse sows are attracting more interest as a means to raise excess piglet production to an appropriate weight for weaning. Primiparous sows have been suggested to be appropriate foster sows as they more readily accept a new litter (Thorup et al., 2004).

When administered at weaning, gonadotrophins such as the combination of 400 IU equine chorionic gonadotrophin (eCG) plus 200 IU human chorionic gonadotrophin (hCG) are effective for reducing and synchronizing the duration of the wean-to-estrus interval in primiparous sows (Estienne and Hartsock, 1998; Kirkwood et al., 1998). Gonadotrophin treatment has the added benefit of increasing the duration of the estrous period and so can facilitate improved breeding management and subsequent farrowing rate and litter size (Knox et al., 2001).

The objective of the present trial was to compare measures of fertility at the second parity of primiparous sows receiving a foster litter for a further 14 d nursing, and their counterparts lactating for only 21 d, that were or were not hormone-treated at final weaning for inducing and synchronizing the post-weaning estrus. It was hypothesized that primiparous sows recruited as nurse sows for an additional 2 wk of lactation would have improved fertility relative to their contemporaries weaned at 3 wk postpartum and, further, that the injection of a combination of 400 IU eCG plus 200 IU hCG at weaning will promote and synchronize the post-weaning estrus and result in improved subsequent farrowing rate and litter size.

2. Materials and methods

2.1. Animals and treatments

This study was approved by the University of Guelph Animal Care Committee. A total of 472 lactating PIC 1050 primiparous sows housed in a commercial 5600-sow facility in Illinois, USA, were used. The trial took place over a year with seven replicate groups of sows involved in the study. Sows farrowing in January, February, March, August, September, October–November, and December of 2011 were randomly assigned to one of four treatments after 3 wk of lactation: (1) W3 ($n = 165$; weaned and no hormone injection, (2) W5 ($n = 103$); initial litter weaned and second litter of 7-d-old piglets fostered-on for an additional 2 wk, no hormone injection when weaned after 5 wk of lactation, (3) W3 + P ($n = 108$; weaned and given IM injection of 400 IU eCG plus 200 IU hCG (PG600®, Merck Animal Health, NJ, USA),and (4) W5 + P ($n = 96$; initial litter weaned and second litter of 7-d-old piglets fostered-on for an additional 2 wk, after a 5-week lactation, weaned and given an IM injection of PG600®. The normal practice on the farm was to wean after 3 wk of lactation and move the sow to the breeding area without injecting hormones, and so in groups where there were extra sows that could not be randomly assigned a treatment (because of a shortage of piglets for fostering) the sows were placed in the W3 group and monitored in a similar manner to other sows in the trial. Because of this decision the W3 group was larger than the other three groups. The foster litters were comprised of 7-d-old pigs subjectively assessed to be small for age and requiring a nurse sow with demonstrated good milking ability. The number of piglets placed on a nurse sow was identical to the number of piglets the sow had been previously nursing.

At weaning, all sows were housed in individual stalls and had once daily fence-line contact with a boar to facilitate estrus detection. Sows were artificially inseminated at detection of their first post-weaning estrus and again 24 h later with 3×10^9 sperm cells in 80 mL extender (Androstar® Plus with CSP™, Minitube, Verona, WI). The sperm was all sourced from the same boar stud throughout the trial and the same genetic lines of boars were used throughout the study. Pregnancy was confirmed at 5 wk post-breeding and pregnant sows grouped in pens of 56–60, allowing 1.7 m^2 per sow until 3 d before their next farrowing due date, when they were moved to individual farrowing pens.

2.2. Animal management

During lactation, sows were fed to-appetite a corn–soybean meal diet with 30% dried distiller's grain (DDG's) formulated to contain 14.7 MJ ME/kg, 20.4% crude protein (CP) and 1.1% total lysine (Lys). From weaning to estrus, sows were fed to-appetite a corn–soybean meal, 40% DDG's diet formulated to contain 13.62 MJ ME/kg, 14.9% CP and 0.53% Lys. Following breeding, sow daily feed intakes were 1.8–3.3 kg, depending on body condition. During the last 2 wk of gestation, feed allowances were increased by 0.5–1.2 kg/d until 3 d prior to their due date and from then on sows were fed 1.8 kg/d, including day of farrowing. Water was available at all times.

Data recorded were; total lactation length, the number of pigs weaned, the weaning-to-estrus interval, service outcome (farrow or not) and subsequent total and live born litter sizes.

2.3. Statistical analysis

Differences in the incidence of estrus and farrowing rates were assessed by logistic regression analysis using a generalized linear mixed model in SAS (PROC GLIMMIX; SAS 9.2, SAS Institute Inc., Cary, NC). Treatment, season, and their interactions were included as fixed effects, and replicates were treated as random effect. The relationship between first lactation length, post-weaning treatment with PG600®, and subsequent litter size was assessed by a two-way ANOVA using a linear mixed model (PROC MIXED) that included the same fixed and random effects as above. Normality of the residuals and presence of outliers were assessed by PROC UNIVARIATE using the Shapiro–Wilk test, Q–Q-plots and externally studentized residuals. When