

Effects of lactation length on weaning-to-first-service interval, first-service farrowing rate, and subsequent litter size

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Summary

Purpose: To analyze the relationship between lactation length and weaning-to-first-service interval, first-service farrowing rate, and subsequent litter size.

Methods: A total of 178,519 litter records from crossbred and purebred sows from 13 commercial herds were analyzed from the PigCHAMP® recordkeeping system.

Results: It appears that parity-three and older sows have the ability to be weaned at lactation lengths as short as 9 days and still retain the ability to recycle in an average of 7 days or less with a subsequent first-service farrowing rate in excess of 70%. Parity-two sows can be weaned at as low as 12 days of lactation and still recycle in an average of 7 days or less. However, parity-one sows weaned below 14 days of lactation required 10 days or more to recycle on average.

Implications: This extended weaning-to-first-service interval in first-parity females was significant when compared to more mature females. In addition, subsequent litter size did not appear to be highly influenced by lactation length.

Keywords: swine, lactation length, weaning-to-first-service interval, first-service farrowing rate, litter size

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Currently, the swine industry is evolving toward weaning litters at earlier ages. This management technique was originally advocated as a means of improving piglet health and has been referred to as medicated early weaning (MEW),¹ modified medicated early weaning (MMEW),² IsoWean®, and segregated early weaning (SEW).³ In addition, it has been linked to improved reproductive efficiency.⁴ This study examined commercial swine herds that use early weaning programs and their associated potential to improve litters per sow per year, a major component of pigs per sow per year. However, before this management practice is widely implemented, we need more information about what effect, if any, decreased lactation length will have on the sows' ability to return to estrus postweaning. Furthermore, the effect of early weaning on the sow's ability to conceive at her initial service and on her subsequent litter size must be examined. Re-

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search has shown that in mature sows, maternal recognition of pregnancy is achieved approximately 10–13 days after the onset of estrus and subsequent mating.⁵ Furthermore, embryonic implantation into the uterine wall appears to be accomplished approximately 13–17 days post-estrus.⁵ Since the uterine environment appears to be ready to maintain pregnancy at 21–28 days postpartum,^{6,7} theoretically, a combined period of lactation length plus weaning-to-service interval as short as 4–8 days may be sufficient to allow a normal reproductive cycle to continue in mature sows. However, previous research does not address any potential differences between mature and first-parity sows. In this study, data from commercial swine producers using the PigCHAMP® recordkeeping system were used to examine the effects of lactation length on weaning-to-first-service interval, first-service farrowing rate, and first-service litter size in commercial sows of differing parities.

For statistical analysis, such parameters as litters per sow per year, return-to-estrus interval, and subsequent litter size are highly dependent upon the system (facilities, management, genetics, etc.) from which they were collected. Therefore, attempts must be made to remove these effects before analyzing the data and drawing general conclusions. However, these conclusions may reflect some systems more closely than others.

Methods

Source of the data

This retrospective study was conducted using PigCHAMP® records obtained from 13 selected commercial herds in the midwestern, southeastern, and southwestern regions of the United States and chosen to represent a cross-section of the swine-producing herds in the country. These herds varied in size from approximately 300 to 2400 sows and included a broad range of breeding and gestation environments (outdoor pens, indoor pens, indoor crates). All 13 herds in this analysis had established successful estrus detection procedures. Insemination was accomplished either through hand-mating or by artificial insemination. The records analyzed were taken from 1985–1995 and included 178,519 litters. As expected, the majority of the records in this dataset indicated that piglets had been weaned at the normal weaning ages of 18–25 days; however, there were a substantial number of records for litters that had been weaned at much younger ages and somewhat older ages (Figure 1). In this dataset:

- 36,124 litters were weaned at lactation lengths of less than 18 days,
- 105,732 litters were weaned at lactation lengths between 18 and 25 days, and
- 36,663 litters were weaned at lactation lengths of more than 25 days.

The farms contributing data also represented a broad range of breeding/gestation environments. Approximately:

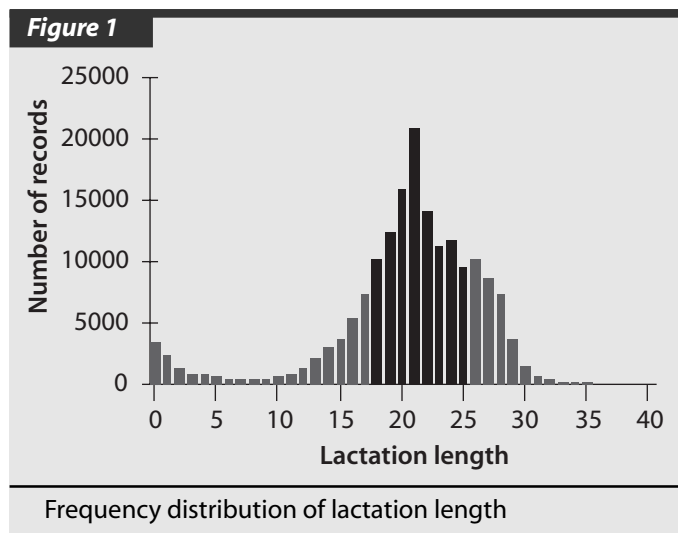
- 55,000 litter records came from five herds with crated breeding/gestation facilities;
- 54,600 litter records came from three herds with combination crate/pen breeding/gestation facilities; and
- 61,500 litter records came from five herds with pen breeding/gestation facilities.

Statistical analysis

The traits we examined included the effect of lactation length on:

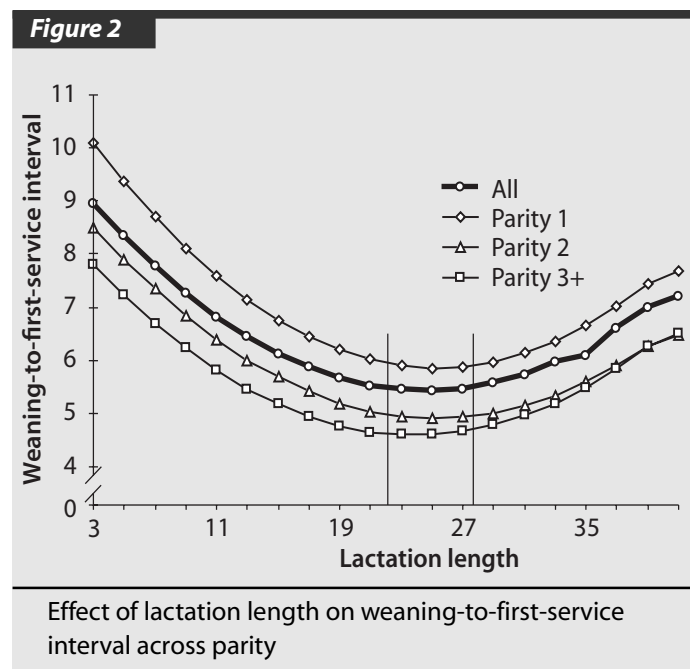
- weaning-to-first-service interval (measuring the ability of the sow to recycle postweaning),
- first-service farrowing rate, and
- litter size associated with the first postweaning service (measuring the subsequent fertility of the sow).

Traits were analyzed using the GLM (General Linear Models) procedure of SAS.⁸ The statistical model used in the analysis included covariates for the linear and quadratic effects of litter weight and lactation length, as well as the fixed effects of herd, group, herd-by-group interaction, parity, and sow genetic type. The herd effect was included to account for the normal variation between herds due to facilities, nutrition, management, etc. The group effect was fit to account for variation due to climate and weather. A herd-by-group interaction was fit to remove variation due to the interaction of each specific herd with season or weather. In addition, a parity effect was included to account for variation due to differing maturity levels of sows, and a sow genetics effect (crossbred or purebred) was fit to remove variation due to the maternal heterosis found in crossbred sows. Unadjusted litter weight, instead of adjusted litter weight, was used to more accurately represent the lactational demands on the sow. In addition, several of the adjustment factors, i.e., parity, were already represented in the model as fixed effects. In analyses of this kind, fixed effects and interactions are used to remove variation due to common factors and, therefore, to allow the final results to more accurately represent the effects of interest.



Results and discussion

Lactation length exerted a significant quadratic effect ($P < .01$) on weaning-to-first-service interval (Figure 2). When analyzed across all parities, with parity included as a fixed effect, the weaning-to-first-service interval appeared to be minimized at a lactation length of 22–27 days. Weaning-to-first-service interval was significantly ($P < .05$) increased when lactation length was either less than 22 days or greater than 27 days. The average weaning-to-first-service interval did not exceed 7 days until the lactation length was less than 14 days. There was, however, a significant ($P < .01$) parity effect of the sow on recycling (Figure 2). Analysis of the data comparing first-parity litters versus second-parity litters versus mature sow litters (parity three and higher) showed the same general effect of lactation length on weaning-to-first-service interval. However, the mean was different by parity with first-parity females taking significantly ($P < .01$) longer to cycle after weaning compared to older sows. Results from this analysis suggest that on average second-parity sows will cycle 2.5 days earlier and mature sows will cycle 3.5 days earlier than first-parity females. These results also suggest that litters from older sows can be weaned as young as 9 days, and on average, the sows will still return to estrus in less than 7 days. Litters from second-parity sows appear to be able to be weaned at as low as 12 days of lactation and the sows will still return to estrus in less than 7 days. However, when the litters from first-parity sows in a farrowing group are weaned at early ages, the time required for them to recycle is 2–5 days longer than that required for older sows in the same group to recycle. Parity differences similar to these results have been previously reported.^{9,10} There have been similar relationships reported between decreased lactation length and increased weaning-to-first-service intervals at lactation lengths below 28 days.^{10–13} These differences in recycling need to be taken into account when the producer is considering a move toward an early weaning nursery pig flow by designing the nutrition and management program to best meet the requirements of these younger sows.



It has been theorized that the number and weight of nursing pigs could influence return to estrus based on the increased lactation demands on the sow.^{14,15} Statistical analysis evaluating the linear effect of unadjusted litter weight on weaning-to-first-service interval showed a small but statistically significant effect. When considering a range in litter weights of 75–200 lb (34–91 kg), the maximum effect appears to be only 0.3 day. Therefore, while this effect is statistically significant, in this dataset it does not appear, in practical terms, that the demand of an increased litter weight is detrimental to the sow's ability to return to estrus postweaning.

We also examined the effect of lactation length on the sow's first-service farrowing rate (Figure 3). It appears that those sows with lactation lengths of more than 12–14 days have a significantly higher ($P < .05$) first-service farrowing rate when compared with sows with a lactation length of less than 12–14 days. This does, however, indicate that sows can be weaned at ages as early as 12–14 days and not suffer a significant reduction in subsequent farrowing rate.

Finally, subsequent litter size was analyzed in relation to the previous lactation length (Figure 4). Although increasing lactation lengths resulted in a statistically significant effect ($P < .01$), the practical magnitude of the effect was smaller than has been previously reported.^{16,17} A reduction in lactation length from 20 days to 15 days would appear to result in an average reduction in litter size of 0.20 pigs per litter born alive in the sow's next litter. A similar reduction in litter size is seen as lactation length is further reduced from 15 days to 10 days.

Implications

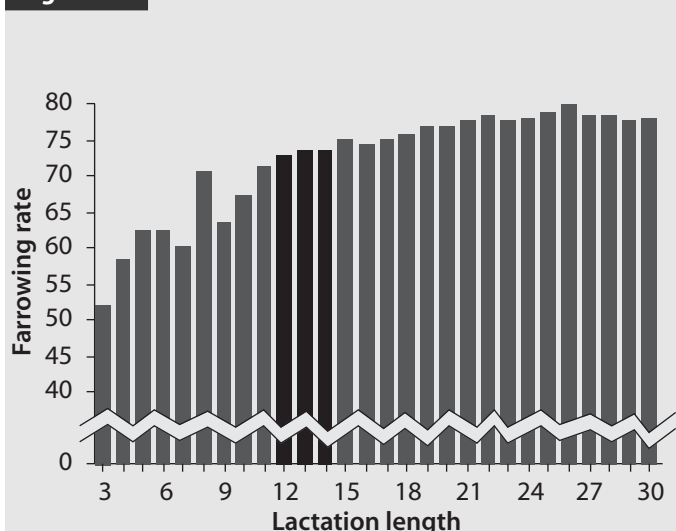
- The results of this study support the theory that sow herd reproductive performance can be improved in early weaning programs.
- It appears that more mature sows (parity three and greater) can recycle and conceive efficiently at lactation lengths as short as 9 days.

- It appears that second-parity sows can recycle and conceive efficiently at lactation lengths as short as 12 days.
- It appears that first parity sows will take 2–4 days longer to cycle than mature sows when lactation lengths are less than 14 days.
- This study suggests that, on average, at a weaning age of 14 days the sow herd can return to estrus within 7 days and have a first-service farrowing rate of more than 70%. However, lactation length accounts for only a portion of the variation in these traits.
- Due to differing needs, young sows need greater attention and different management to achieve maximum production.
- Therefore, further study is needed to quantify other significant effects and to improve the consistency at which sows rebreed after shorter lactation lengths.

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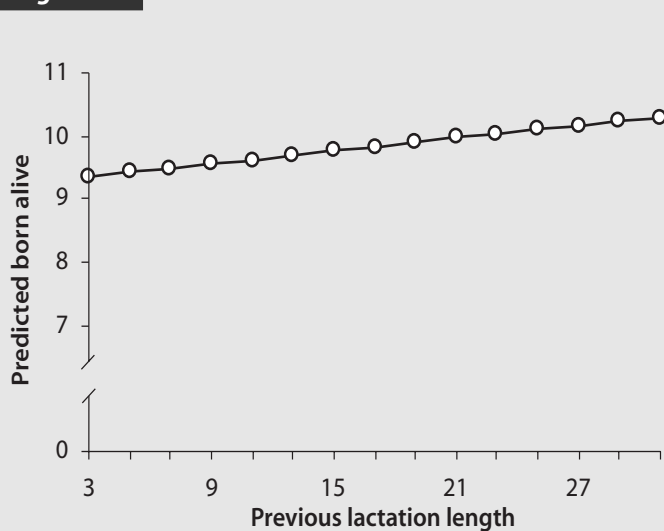
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Figure 3



First service farrowing rate by lactation length

Figure 4



Effect of lactation length on subsequent-parity born alive

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