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Influence of the lactation length in the subsequent litter size of sows

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Abstract

The aim of this study was to evaluate the influence of lactation length (LL) on the subsequent litter size (LS) in pluriparous and primiparous sows Eighteen commercial hog farms were analyzed over a seven-year period (1996-2003). Feed of the lactating animals was based on commercial ration and water *ad libitum*, with 79.729 parities grouped into five LL: 8 to 13, 14 to 15, 16 to 17, 18 to 21 and 22 to 25 days. Increased litter size of the subsequent parity ($P<0.05$) was observed as the lactation period was extended in the pluriparous sows, with 10.70 ± 0.5; 11.16 ± 0.2; 11.15 ± 0.2; 11.34 ± 0.1; 11.87 ± 0.3 for the periods of 8 to 13, 14 to 15, 16 to 17, 18 to 21 and 22 to 25 days, respectively. However, periods of 14 to 15 and 16 to 17 did not show any difference ($P>0.05$). The primiparous sows produced smaller litter size over the periods of 8 to 13 (10.34 ± 0.9), 14 to 15 (10.41 ± 0.5) and 16 to 17 (10.46 ± 0.6) days, compared to LLs of 18 to 21 (10.68 ± 0.5) and 22 to 25 (11.43 ± 0.8) days. Both the multiparous and primiparous sows had LL from 22 to 25 days, resulting in higher LS ($P<0.05$), when compared to other LL. It can be concluded that the lactation period has an effect on litter size, with the 22 to 25 length providing better results in the litter size of subsequent parity of the female swine.

Keywords: Swine, lactation length, litter size

Introduction

Reduction of lactation length (LL) has been adopted as a procedure seeking to improve the sanitation conditions of early weaned and segregated piglets. Another objective is increased frequency of farrowing, resulting in a larger production of pigs per sow per year (Machado *et al*., 2000). Thus, several studies have been carried out aiming at further understanding the effects of LL reduction on the reproductive efficiency of the sow and in the post-weaning performance of the weaned piglets (Allrich *et al*., 1979; Dewey *et al*., 1994; Le Cozler *et al*., 1997; Koketsu *et al*., 1997a; Koketsu and Dial, 1998; Belstra *et al*., 2002).

A minimum period of days is required after parity for the stabilization of the hypothalamus-hypophysis-ovary system, which is not totally functional until 2-3 weeks *postpartum* (Elsaesser and Parvizi, 1980). The reduced ovarian activity in this period could be correlated with the high serum concentrations of prolactin and oxytocin. However, these negative effects are suppressed after weaning, allowing the sows to display estrus signs (Bevers *et al.*, 1981; Varley and Foxcroft, 1990).

Sow culling rate tends to increase with decreased LL (Xue *et al*., 1997). Such fact is corroborated by Tantasuparuk *et al*. (2001), who verified a shorter lifetime production in early-weaned primiparous sows. However, the great variety of factors responsible for sow culling make it difficult to analyze the cause-effect relationship involved (Tantasuparuk *et al*., 2001; Machado *et al*., 2000).

The correlation between LLs on the subsequent litter size these two conditions was verified by several researchers (Allrich *et al.*, 1997; Xue *et al.*, 1993; Dewey *et al.*, 1994; Le Cozler *et al.*, 1997; Koketsu *et al.*, 1997a; Koketsu and Dial, 1998; Tammaruk *et al.*, 2000).

It has been verified that reduction of LL increases the weaning-to-service interval (WSI). According to Xue *et al.* (1993), LL of one or two weeks

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is associated to long WSI. Additionally, Lúcia Jr. (1999) verified that a 10 day reduction in LL corresponds a one day increase in WSI.

Reduction of LL reduces farrowing interval, which could increase the number of piglets weaned per sow per year (Xue *et al*., 1993). However, opposite results were observed by Machado *et al*. (2000), who reported smaller litter size following ultraearly weaning (less than 14 days), compared to the annual production obtained by 14 to 17 days LL.

Pinheiro (2000) observed that sows submitted to a lactation length of up to 14 days have late ovulation in the post weaning estrus. Such condition may be associated to low synthesis and release of gonadotropins, characteristic of animals with very short LL (Varley and Foxcroft, 1990).

When comparing LL of 21-30 days, Allrich *et al*. (1979) did not find influence on ovulation and fecundation rates. However, several researchers reported that the embryonic survival rate increases with the increase of LL from 14 to 30 days (Allrich *et al.*, 1979; Dewey *et al.*, 1994; Foxcroft and Aherne, 2000). Belstra (2002) also verified that the increase of LL from two to four weeks produces a larger number of viable embryos.

Some studies have presented different results, when correlating the adverse effects of short lactation lengths on subsequent litter size. This effect seems to be more evident in sows after parity 3 (Foxcroft and Aherne, 2000), although Xue *et al.* (1993) did not find any effect of parity order. Dewey *et al.* (1994) did not report any significant difference in the subsequent litter size of LLs from eight to 22 days, while Nogueira *et al.* (1983) and Clarck and Allen (1987) obtained an increase in the litter size of 0.02 and 0.01 more pigs per day of lactation . Greater influence on LS was found by Xue *et al.* (1993), who reported an increase of 0.06 pigs for each extra day of lactation, from 17 to 30 days.

Evaluating shorter LLs, Koketsu and Dial (1998) verified an increase in the subsequent litter size, when LL was longer than 13 days. However, Gaustad-Aas *et al.* (2004) reported that the subsequent litter size can be compromised when lactation length is only three weeks.

The aim of this work was to evaluate the influence of the subsequent litter size on ultraearly, early and traditional lactation lengths.

Material and Methods

Eighteen commercial hog farms were evaluated during a seven year period (1996-2003) in the state of Minas Gerais, Brazil. The reports on sow lactation and reproduction were extracted from the Suinsoft® or PigCHAMP® programs and later electronically compiled for subsequent statistical analysis.

During the lactation period, the sows were fed commercial ration and water *ad libitum*. Each sow was properly identified as follows: parity number, parity date, weaning date, service date, lactation length (LL) and litter size (LS).

Sows were grouped into primiparous or pluriparous, according to parity order. Appraised LLs were classified as ultraearly (down to 13 days), early (14-17 days) and traditional (18-25 days) in agreement with the nomenclature of Sesti and Moreno (1997), cited by Machado *et al.* (2000).

Lactation length longer than 25 days was not used (traditional european weaning), since such practice was not adopted by the farms studied. Early and traditional LLs were distributed into subgroups, to evaluate likely differences in the reproductive performance among them. Thus LLs were defined in function of the lactation days as following: 8-13 (ultraearly), 14-15 (early), 16-17 (early), 18-21 (traditional) and 22-25 (traditional).

LLs shorter than eight days were not analyzed due to the low number of repetitions. Sows with weaning–to–conception interval longer than 15 days or repeating estrus after service were not evaluated either.

Data of 79.729 parities were used for statistical analysis. The variable studied (litter size) was submitted to homocedasticity (Bartlett) and normality (Lilliefors) tests, followed by variance analysis (ANOVA). If significant, it was submitted to the Duncan test at 5% probability (Sistema, 1999).

Results

The results obtained on LL influence on litter size are presented in Tab.1. It was verified for the primiparous sows that LS was shorter (10.34 ± 0.9 piglets; $P<0.05$) in LL from eight to 13 days, as compared with traditional weanings (18-21 and 22-25 days), in which a LS of 10.68 ± 0.5 and 11.43 ± 0.8 piglets, was verified, respectively. As for the pluríparous sows LL from eight to 13 days presented a shorter LS (10.70 ± 0.5 piglets; $P<0.05$), compared to the other treatments. LL from 22 to 25 days, both for pluríparous and primíparous sows resulted in larger LL (11.87 ± 0.3 and 11.43 ± 0.8 piglets, respectively), compared to the other treatments.

Table 1. Average of litter size (LS) of primiparous and pluriparous sows submitted to different lactation lengths and respective parity number (N).

Lactation length	Primiparous		Pluriparous	
	N	LS	N	LS
8 TO 13 DAYS	1.074	10.34 ± 0.9^{a}	3.513	10.70 ± 0.5^{a}
14 and 15 days	2.911	10.41 ± 0.5^{a}	13.951	11.16 ± 0.2^{b}
16 and 17 days	2.249	10.46 ± 0.6^{a}	16.095	11.15 ± 0.2^{b}
18 TO 21 DAYS	2.987	10.68 ± 0.5^{b}	24.069	11.34 ± 0.1^{c}
22 to 25 days	1.186	11.43 ± 0.8^{c}	8.692	11.87 ± 0.3^{d}
Total	10.867	10.86 ± 0.3	68.862	11.44 ± 0.1

Averages with different letters in the same column differ (P<0.05) by the Duncan test.

Discussion

This work presents interference of some LLs in the subsequent LS. Correlations between these conditions were also observed by several authors (Allrich *et al.*, 1979; Xue *et al.*, 1993; Dewey *et al.*, 1994; Le Cozler *et al.*, 1997; Koketsu *et al.*, 1997a; b; Koketsu and Dial, 1998; Tammaruk *et al.*, 2000).

Weanings from 8-13 d (ultraearly), 14-15 d and 16-17 d (early) in primiparous sows, as well as early weaning in pluriparous sows (14-15 and 16-17 days) did not present any difference (P>0.05) regarding LS (Tab.1). Similar behaviors was observed by Koketsu and Dial (1998) in pluriparous sows with LL from 14 to 16 days and 17 to 19 (11.39 and 11.40 pigs, respectively).

Several works on early weaning report that uterine involution is not essential for the next gestation to be established (Koketsu *et al.*, 1997b; Corrêa *et al.*, 2002). However, until the 18th day *post-partum*, the uterus is still recovering (Hafez, 1995). This could explain the absence of differences in LLs with LL up to 16-17 days due to interference in embryonic survival. Thus, uterine involution may be the main factor contributing to a low embryonic survival and, consequently, reduced litter size of sows with early weaning (Allrich *et al.*, 1979; Koketsu and Dial, 1998; Foxcroft and Aherne, 2000; Machado *et al.*, 2000). Associated to these factors, the presence of the lochia and countless pleats in the uterine mucous membranes can hinder embryonic implantation or provoke the death of the embryos (Grunert and Birgel, 1982).

The negative influence of a short lactation length on the subsequent litter size could be associated with lower ovarian activity and lower LH secretion (Britt *et al.*, 1985; Varley and Foxcroft, 1990).

LL of 14 and 15 days showed a significant increase in pluriparous sows (1.1 pig) in LS, when compared to ultraearly weaning (8-13 days), while in the primiparous sows this condition does not occur. These results suggest that *post-partum* recovery is less efficient in primiparous sows, probably due to a the greater animal wear, following less ration consumption during this period. According to Koketsu et al. (1997a,b) the adverse effects of short LL on the subsequent reproductive performance are less intense in females that maintain a high ration consumption during lactation.

LL of 16-17 days in primiparous sows showed a shorter LS in the subsequent parity (P>0.05) than in those submitted to traditional (18-21 and 22-25 days), possibly due to the complete uterine involution in 18 days *post-partum* (Hafez, 1995). These results differ from those found by Koketsu and Dial (1998), who did not observe any difference in LS, when comparing LL ranging from 8 to 28 days. Parity number evaluated in this experiment (10.867) was very high, and may have contributed to the differences found. This condition is justified since the variable LS is very unstable, (high coefficient of variation), demanding a high number of repetitions in the analysis.

The present experiment had an increase of 1.1 pigs in primiparous LS with an increase in LL from eight to13 days (ultraearly weaning) to LL from 22-25 days, when the animals had traditional weaning (Tab.1). These results were similar to those obtained by Allrich *et al.* (1979), when comparing LLs of 21 with 30 days (an increase of 1.4 pigs). However, lower rates were found by Le Cozler *et al.* (1997) comparing LLs of 19 with 29 days (increase of 0.6 pigs in LL) and by Xue *et al.* (1993), who observed an increase of 0.7 piglets with the increase of LL from 17 to 30 days. The large differences in the range of the periods studied in this experiment compared to other works makes comparison difficult.

An increase of 1.2 pigs in the LS of pluriparous sows, with an increase in LL from eight-13 days (ultraearly weaning) to 22-25, when the animals had traditional weaning (Tab.1). These results were similar to those reported by Le Cozler *et al.* (1997), who observed an increase of 1.4 pigs in LS, when evaluating sows of 3 to 7 parities, with extended LL of 11-13 days to 13-28 days, respectively.

For both pluriparous and primiparous sows, the best LS results were verified in LL from 21-25

days (traditional weaning), indicating that in that period the uterine recovery had been already established, according to Hafez (1995). However, very long lactation length can reduce the number of piglets weaned per female per year, in comparison with a shorter LL (Koketsu *et al.*, 1997b), which shoud be considered when defining the ideal LL. In conclusion, lactation length influences the subsequent litter size, with the period of 22-25 days (traditional weaning) providing better results.

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