

## Risk Factors Affecting the Drop of Litter Size at Second Parity in Sows in La Piedad Michoacan, Mexico

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### Abstract

A problem attributed to first parity sows is the second litter syndrome (the number of piglets of the second litter is lower or similar to the first litter). The objectives of this study were to estimate the frequency of sows showing the second litter syndrome and to determine the effect of some risk factors on the drop of the litter size of second parity sows in a commercial farm in La Piedad Michoacan, Mexico. Data on 6809 sows were used. The data were analyzed by a binomial logistic regression model. The model included the fixed effect of year and season of farrowing, breed group, weaning to service interval and pigs born alive at first parity. 48.1% of the sows showed the syndrome. Year of farrowing, weaning to service interval and pigs born alive had effect ( $P < 0.05$ ) on the second-litter syndrome. Sows with more than 17 days weaning to service interval had lower odds, and sows with large litters born alive at first parity had higher odds of a drop in litter size at second parity. Therefore, greater attention should be given to first parity sows with large litters at first parity.

**Keywords:** Breed, Litter size, Parity, Pigs, Risk factors.

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### 1. Introduction

First parity sows have the highest risk of prolonged weaning to oestrus intervals and low pregnancy rates after service [1]. Another problem attributed to first parity sows is the second litter syndrome; this means that the number of piglets in the second litter of the sows is lower or similar to the first litter [2, 3], which negatively influences reproductive efficiency of second parity sows and thereby farm productivity [4]. Since reproductive failure is one of the main reasons for culling young sows [5], improving second parity reproductive performance might also increase sow stayability in the farm and thereby decrease replacement costs.

In the United States of America, 40% of the herds showed the second litter syndrome, most likely due to a low ovulation rate or an increased embryonic mortality [2]. The drop of litter size and farrowing rate in second parity sows are often related to an excessive weight loss during the first lactation [6, 7]. Since litter sizes at farrowing and number of piglets weaned have increased in the last decade as result of genetic improvement, the metabolic demands on first litter sows have also increased, whilst feed intake did not. Furthermore, selection on short weaning to oestrus interval has reduced it and most sows come in oestrus 4-5 days after weaning. This short period, might not be sufficient for sows to recover from high lactation weight losses. Therefore, both the higher weight loss and short weaning to oestrus interval can negatively influence follicle and oocyte development and/or embryonic survival and make sows more prompt for reduced litter sizes in

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second parity. Factors such as herd size, season, and litter size at first parity have been reported as risk factors for the second litter syndrome [8]. In the central region of Mexico, there are no reports of the frequency of and factors affecting the drop of litter size in second parity sows. Therefore, the aims of this study were to estimate the frequency of sows showing the second litter syndrome and to determine the effect of some risk factors on the second litter syndrome in a commercial system in La Piedad Michoacan Mexico.

## 2. Materials and methods

### *Localization and climate*

A retrospective study was carried out from 1999 to 2008 using the database of the first site of a three site commercial pig farm with approximately 2400 sows in La Piedad, Michoacan, Mexico. The farm was located between 20° 12' and 20° 24' north and 101° 56' west, at 1,675 meters above sea level [9]. The climate of the region is temperate, with average temperature of 19.6°C, with warm summers, and average rainfall of 784 mm mainly from June to September. Pig production is the second most important activity in the Piedad region. Sows in the farm belonged to the PIC, Yorkshire and ¼ Landrace ¾ Yorkshire (1/4L3/4Y) breed groups, and were vaccinated against common diseases in the region. Sows were reproduced mainly by artificial insemination. During gestation sows were fed 2.5 kg per day for the first two months, 2.8 kg per day the third month and 3.4 kg per day for the remaining gestation. During lactation sows were housed in individual farrowing crates and were fed progressively from 2 to 6 kg/sow of a commercial diet (15.5% crude protein). During the weaning to insemination interval, sows were individually housed in crates and were fed a commercial gestation diet with a maximum of 3.5 kg of per day. Sows were checked for oestrus twice a day using a mature boar.

### *Data and risk factors*

Data on 6809 sows with first and second parities were used. The response variable was the second litter syndrome, which was defined as a sow with the same or fewer number of pigs born alive in parity 2 as compared to parity 1 [2]. Therefore, sows were categorized into two groups: sows with

similar or at least 1 piglet less and those with at least 1 piglet more at second parity.

The risk factors were: year of farrowing (1999-2008), season of farrowing (spring, summer, fall and winter), breed group of the sow (PIC, York, 1/4L3/4Y), interval weaning to service (<5, 5-6, 7-17, >17), number of pigs born alive at first litter (<7, 7-8, 9-10, >10).

### *Statistical analysis*

The second litter syndrome data were analyzed by a binomial logistic regression model. The model included the fixed effect of year of farrowing, season of farrowing, breed group, weaning to service interval and number of pigs born alive. The statistical analyses were carried out with the logistic procedure of the SAS software [10].

## 3. Results and discussion

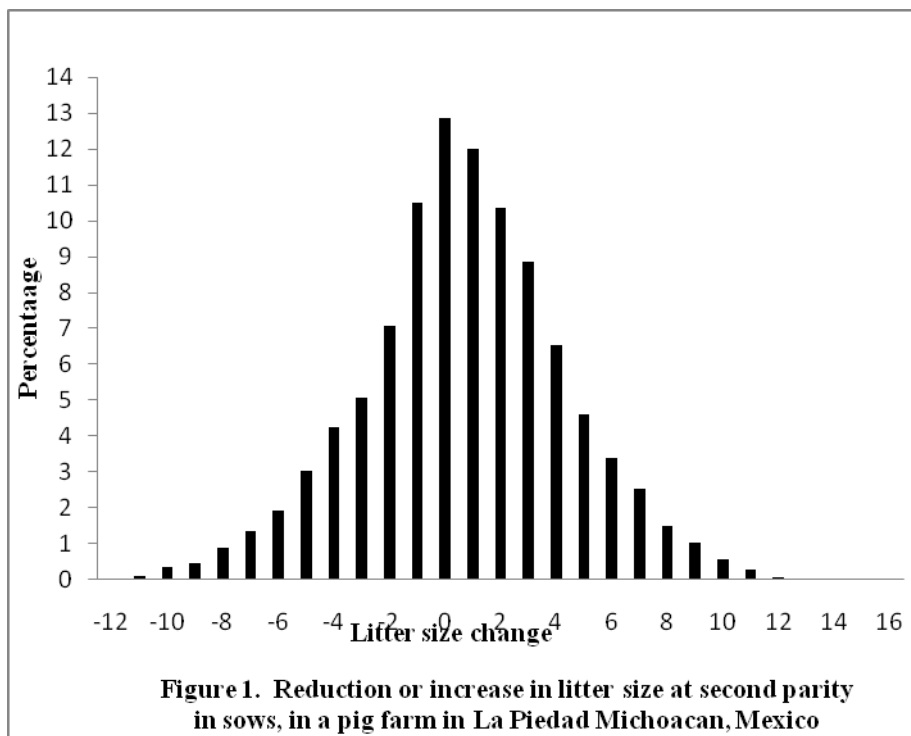
The frequencies of sows with the second-litter size syndrome are shown in Figure 1. Thirty five point two percent of the sows had at least one piglet less at second parity, 12.9% had similar and 51.9% had at least one piglet more at second parity as compared with first parity sows; therefore 48.1% of the sows presented the litter size syndrome. The mean pigs born alive for sows with a drop in litter size was  $7.0 \pm 2.7$  and  $9.51 \pm 2.02$  for sows with increased litter size at parity 2, respectively. Overall, sows in parity 2 had 0.76 more piglets than those in parity 1 (mean= 7.88 piglets).

The percent of sows (48.1%) showing the second litter syndrome, in this study, is within the range of reported values in other countries, where 40 to 60% of the second parity sows show the syndrome (3,12-14). Also a lower litter size in the second parity as compared to the first parity has been reported by other authors [1, 2]. The reduction in litter size after the first farrowing is probably due to a lower rate of ovulation and to an increase in embryo mortality because gilts are more susceptible to lose weight during lactation and have not finished their corporal development yet [1]. This suggests that better management and care is needed for the first parity sows in order to improve the efficiency and profitability of farms.

Risk factors effects are shown in Table 1. Significant effects of year of farrowing, weaning to service interval and pigs born alive on the second-litter syndrome were found. The risk of

decreased litter size at second parity was high in later years (2004-2008). Year of farrowing is a complex factor of poor practical value, which effect is probably associated to management practices, owner decisions, climatic changes and other factors; however, it is an important source of variation to be included in the statistical model. The odds of a drop in litter size at parity 2 tend to be high for sows farrowing in the summer and fall season; however, season effect was not significant

( $P>0.05$ ). Season effect on the second litter syndrome has been reported in France (8). The sows with more than 17 days weaning to service interval had lower odds of reducing litter size from parity 1 to 2 than sows with shorter intervals (Table 1). Some authors mention that when the weaning to estrus interval is longer than 11 days, and the sows get pregnant, the litter size is smaller in the next farrowing [2, 11, 12].



The odds of the a drop in the second litter was 3.8, 12.0 and 51.7 3.8 times greater as litter size at first parity increased (Table 1). The effect of first litter size on second litter size has been reported previously [8]. This can be explained partially, by the fact that as a result of the genetic improvement, commercial sows have a high prolificacy that is expressed from first parity. In consequence, as mentioned before, sows show an increase in the weaning to estrus interval and a reduction in litter size at the second parity, due probably to a low ovulation rate and an increase in embryonic mortality caused by the weight lost during lactation [1]. Also, first parity females have not finish to growth, which may contribute to the

drop of litter size in second parities. Also young sows that produce large litter sizes may suffer greater body weight loss during lactation, which affect litter size. Therefore, better care and management should be given to sows with large litter at first parity, especially those with litter greater than 10 piglets (Table 1). Breed group effect on the second litter syndrome was not significant ( $P<0.05$ ) suggesting that sows of the breed groups here studied had similar prolificacy. However, more prolific breeds will be at a high risk of smaller litters at the second parity as suggested by the effect of litter size at first farrowing on second litter size.

**Table 1.** Factors associated with the second litter syndrome in a commercial pig farm in Michoacan, Mexico, using binomial logistic regression

Factor	Number of sows	Estimate	Standard Error	Odds Ratio	95% Wald Confidence Limits
<b>Year of farrowing</b>					
1999	809	-0.5076	0.1259	0.602	0.470, 0.770
2000	770	-0.3518	0.1107	0.703	0.566, 0.874
2001	802	-0.2599	0.1183	0.771	0.612, 0.972
2002	528	-0.4813	0.1305	0.618	0.479, 0.798
2003	269	-0.76.12	0.1745	0.467	0.332, 0.658
2004	365	-0.1060	0.1527	0.899	0.667, 1.213
2005	398	-0.0518	0.1396	0.950	0.722, 1.248
2006	624	0.0297	0.1277	1.030	0.802, 1.323
2007	1095	-0.1644	0.1029	0.848	0.693, 1.038
2008	1149	0		1	
<b>Season of farrowing</b>					
Spring	1842	-0.0103	0.0795	0.990	0.847, 1.157
Summer	1535	0.1285	0.0838	1.137	0.965, 1.340
Fall	1660	0.1311	0.0841	1.140	0.967, 1.344
Winter	1772	0		1	
<b>Genotype</b>					
PIC	3509	0.1236	0.0857	1.132	0.957, 1.339
Yorkshire (Y)	2178	0.1746	0.0944	1.191	0.990, 1.433
1/4L3/4Y*	1122	0		1	
<b>Weaning to service interval</b>					
≤4	1390	0.2982	0.0875	1.347	1.135, 1.600
5-6	2139	0.3220	0.0795	1.380	1.181, 1.612
7-17	1720	0.3070	0.0826	1.359	1.156, 1.598
>17	1557	0		1	
<b>Pigs born alive</b>					
≤6	1807	0		1	
7-8	1761	1.3252	0.0838	3.763	3.193, 4.435
9-10	2394	2.4864	0.0811	12.018	10.251, 14.089
>10	844	3.9450	0.1307	51.677	39.999, 66.764

\*Landrace

#### 4. Conclusions

The most important risk factor that affects the second litter syndrome was the litter size of the sow at first parity. Therefore, greater attention should be given to first parity sows with large litters.

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