Abstract W136

Effect of proportion of females on number of piglets born alive and pre-weaning growth traits in Pietrain swine in Thailand

T. Punsanit*, S. Koonawootrittriron*, T. Suwanasopee*, M. A. Elzo†

*Department of Animal Science, Kasetsart University, Bangkok 10900, Thailand

† Department of Animal Sciences, University of Florida, Gainesville, FL 32611-0910, USA

SUMMARY

The objective of this study was to assess the effect of proportion of female piglets born alive (FPB) on litter size and pre-weaning growth traits of piglets in a litter. Traits were total number of piglets born alive (NBA), average birth weight per litter (BW), average weaning weight per litter (WW) and average daily gain per litter (ADG). There were 3,583 litters from 1,252 negative halothane Pietrain sows that farrowed from 2004 to 2007 in a commercial population in Thailand. Sows were raised in an open-house system and received the same management and health care. The FPB was defined as the proportion of female to all piglets in a litter, and classified as LG1 (0 ≤ FPB ≤ 20 %), LG2 (20 < FPB ≤ 40 %), LG3 (40 < FPB ≤ 60 %), LG4 (60 < FPB ≤ 80 %) and LG5 (80 < FPB ≤ 100 %). Seasons were summer (March to June), rainy (July to October), and winter (November to February). Parity was classified as 1, 2, 3, 4, 5, 6, 7, and ≥ 8. The model had year-season, parity, and FPB as fixed effects, and boar and residual as random effects. First parity sows had the lowest least squares means (LSM) for all traits and increased in later parities (P < 0.05). The LSM for NBA of sows in LG3 (8.41 ± 0.07 piglets) was the highest of all litter groups (P < 0.05), and sows in LG2 (8.04 ± 0.08 piglets) and LG4 (7.95 ± 0.09 piglets) had higher NBA LSM than sows in LG1 (6.61 ± 0.13 piglets) and LG5 (6.42 ± 0.17 piglets). However, LSM for BW were lower for sows in LG2 (1.73 ± 0.01 kg), LG3 (1.72 ± 0.01 kg) and LG4 (1.73 ± 0.01 kg) than those for sows in LG1 (1.77 ± 0.01 kg) and LG5 (1.75 ± 0.02 kg). Similar trends were found for WW and ADG. Sows in LG1 had the highest LSM for WW (7.35 ± 0.08 kg) and ADG (234.51 ± 3.05 g/d), and then declined towards LG4 and LG5.

INTRODUCTION

The proportion of female piglets in a litter is important for producing replacement gilts. Proportion of male and female piglets per litter is different among farms depending of the objectives of their operations. Some farms may require larger number of males than females to be used as boars or for fattening, whereas other farms may require larger number of females than males as replacement sows. Different sex ratios in a litter may influence the level of competition among piglets, which may in turn affect individual piglet survival and growth performance. Thus, the objective of this study was to assess the effect of proportion of female piglets born alive (FPB) on litter size and pre-weaning growth traits of piglets in a litter, were raised in open house under the environmental conditions of Thailand.

MATERIALS AND METHODS

Animals and Data. The dataset included information on total number of piglets born alive (NBA), average birth weight per litter (BW), average weaning weight per litter (WW) and average daily gain per litter (ADG) from 1,252 Pietrain sows. Data were collected from 2004 to 2007 in a commercial negative halothane gene Pietrain swine population. Sow means and standard deviations were 7.96 ± 2.32 piglets for NBA (4.09 ± 1.84 male and 3.87 ± 1.83 female piglets), 1.74 ± 0.24 kg for BW (1.76 ± 0.26 kg for male piglets and 1.72 ± 0.26 kg for female piglets), 7.02 ± 1.13 kg for WW (7.63 ± 1.25 kg for male piglets and 6.90 ± 1.12 kg for female piglets), and 222.22 ± 45.24 g/day for ADG (245.01 ± 50.26 g/day for male piglets and 217.70 ± 45.30 g/day for female piglets).

Management and Nutrition. The average temperature in this region was 28.5°C (ranged from 20 to 34°C), and the mean relative humidity was 77.3% (ranged from 53 to 97%). Seasons were classified as winter (November to February), summer (March to June), and rainy (July to October). Sows were raised in an open-house system. Gestating sows were kept in individual stalls, and lactating sows were kept in individual farrowing pens. Floors (slats) in all barns were approximately 2.2 to 2.5 meters above ground. Animals were raised on the floor, and the space under the floor was used for ventilation and drainage. In summer, when temperatures were too high (above 35 ºC), fans and water dripping were used to reduce heat stress.

Replacement gilts were selected based on general appearance, pedigree and estimated breeding values for improving hip width (31.59 ± 1.81 cm), shoulder width (31.32 ± 2.19 cm), body length (94.14 ± 4.16 cm), and number of nipples (13.23 ± 0.97 nipples). At this stage, they were fed 2.0 to 2.5 kg concentrate daily (16% protein; 3,100 Kcal DE), and increased to 3.0 to 3.5 kg concentrate daily 10 days before the expected estrus date. When selected gilts or sows showed estrus, they were artificial inseminated with a selected boar chosen using the same improvement criteria. Gilts and sows were artificially inseminated twice at each estrus with the same boar; firstly at the time estrus was detected, and secondly 12 hours after the first insemination. Pregnant gilts and sows were moved to individual farrowing pens 1 week before the expected farrowing date. At farrowing, piglets were indentified, weighted, and their pedigree recorded, and sows were recorded for NBA and BW. Nursling sows were fed 1.8 to 2.0 kg concentrate daily (18% protein; 3,300 Kcal DE). Piglets were nursed with their dam until 21 to 28 days of age (23.60 ± 1.67 days). At weaning, piglets were weighted and counted, and sows were recorded for WW and ADG of their weaned piglets. Vaccines for pseudo rabies, food and mouth disease, swine fever, and parvo virus were given to all gilts and sows. Deworming was applied every 4 months.

Statistical Analysis. Parities were classified as 1, 2, 3, 4, 5, 6, 7, and ≥ 8. The proportion of female piglets born alive (FPB) was defined as the proportion of female to all piglets in a litter, and classified as LG1 (0 ≤ FPB ≤ 20 %), LG2 (20 < FPB ≤ 40 %), LG3 (40 < FPB ≤ 60 %), LG4 (60 < FPB ≤ 80 %) and LG5 (80 < FPB ≤ 100 %). The mixed model considered year-season, parity, and FPB as fixed effects, and boar and residual as a random effect. Least square means (LSM) for NBA, BW, WW, and ADG were estimated for all subclasses of factors included in the model.

Table 1. Least square means and standard error of number born alive (NBA), average birth weight of piglets (BW), average weaning weight of piglets (WW) and average daily gain of piglets (ADG) by parity¹

Parity	Number of Records	NBA (piglet)	BW (kg)	WW (kg)	ADG (g/d)
1	764	6.74 ± 0.09^{a}	1.66 ± 0.01^{a}	6.75 ± 0.05^{a}	213.98 ± 1.95^{a}
2	731	7.29 ± 0.09^{b}	1.77 ± 0.01^{c}	7.16 ± 0.05^{b}	227.51 ± 1.94^{b}
3	580	7.68 ± 0.10^{c}	1.77 ± 0.01^{c}	7.25 ± 0.05^{b}	231.29 ± 2.15^{b}
4	440	7.77 ± 0.11^{c}	1.77 ± 0.01^{c}	7.24 ± 0.06^{b}	229.05 ± 2.32^{b}
5	349	7.74 ± 0.12^{c}	1.75 ± 0.01^{c}	7.17 ± 0.07^{b}	229.15 ± 2.61^{b}
6	269	7.77 ± 0.14^{c}	1.74 ± 0.01^{b}	7.16 ± 0.07^{b}	226.97 ± 2.91^{b}
7	206	7.65 ± 0.16^{c}	1.75 ± 0.02^{c}	7.31 ± 0.08^{b}	232.98 ± 3.25^{b}
>8	244	7.26 ± 0.15^{b}	1.71 ± 0.01^{b}	7.14 ± 0.08^{b}	229.04 ± 3.16^{b}

¹Different superscripts indicate P < 0.05

RESULTS AND DISCUSSION

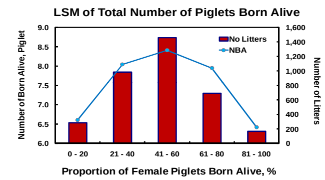
Year and Season. Sow LSM for NBA, BW, WW, and ADG differed across year-season subclasses (P < 0.001). The LSM ranged from 6.44 ± 0.17 piglets (2004-summer) to 7.92 ± 0.12 piglets (2007-summer) for NBA, from 1.59 ± 0.02 kg (2004-winter) to 1.98 ± 0.01 kg (2006-winter) for BW, from 6.21 ± 0.07 kg (2007-summer) to 7.62 ± 0.10 kg (2004-winter) for WW, and from 190.79 ± 2.57 g/day (2007-summer) to 251.71 ± 3.92 g/day (2004-winter) for ADG. Variation of these traits may have been influenced by changes in weather patterns across years and seasons (temperature and humidity) and variability in the quality of management and health care by temporary workers.

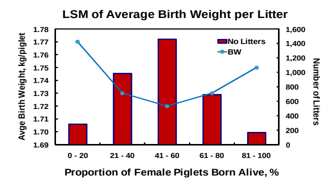
Parity. Parity had influence on all traits (P < 0.001). First parity sows had lower LSM for NBA (6.74 ± 0.09 piglets), BW (1.66 ± 0.01 kg), WW (6.75 ± 0.05 kg), and ADG (213.98 ± 1.95 g/day) than later parity sows (7.26 ± 0.15 piglets to 7.77 ± 0.14 piglets for NBA, 1.71 ± 0.01 kg to 1.77 ± 0.01 kg for BW, 7.14 ± 0.08 kg to 7.31 ± 0.08 kg for WW, and 226.97 ± 2.91 kg to 232.98 ± 3.25 kg for ADG). Differences between primiparous and multiparous sows were likely due to changes in physiology, degree of maturity, and body condition.

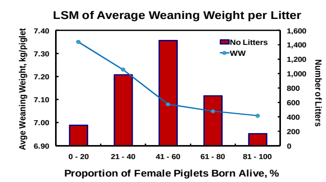
Proportion of Female Piglets Born Alive (FPB). There were important effects of FPB on NBA (P < 0.001), BW (P < 0.05),WW (P < 0.001) and ADG (P < 0.001). The LSM for NBA of sows in LG3 (8.41 ± 0.07 piglets; 40 < FPB ≤ 60 %) was the highest of all litter groups (P < 0.05), and sows in LG2 (8.04 ± 0.08 piglets; 20 < FPB ≤ 40 %) and LG4 (7.95 ± 0.09 piglets; 60 < FPB ≤ 80 %) had higher LSM for NBA than sows in LG1 (6.61 ± 0.13 piglets; 0 ≤ FPB ≤ 20 %) and LG5 (6.42 ± 0.17 piglets; 80 < FPB ≤ 100 %). The pattern of NBA classified according to FPB found in this Pietrain population could be related to larger embryo and(or) fetal losses for a particular sex (male or female) during intrauterine development. Assuming an approximately equal sex ratio of Y and X sperms in boars, the proportion of male and female embryos could have been similar after fertilization. Subsequently, during the embryonic and fetal stages, uneven losses by sex occurred, producing litters with a variety of male:female ratios, and decreasing NBA in the process.

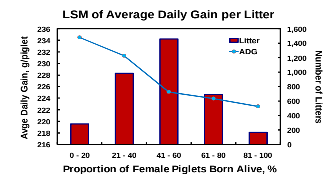
The LSM for BW were lower for sows in LG3 (1.72 ± 0.01 kg), LG2 (1.73 ± 0.01 kg), and LG4 (1.73 ± 0.01 kg) than those for sows in LG1 (1.77 ± 0.01 kg) and LG5 (1.75 ± 0.02 kg). This concave trend for BW (Figure 1b) was the opposite to the convex trend observed for NBA (Figure 1a). This negative association between BW and NBA could be related to the relationship between number of embryos and uterine capacity of sows (blood flow, uterine protein secretion, size of placenta, efficiency of nutrient transport, fetal nutrient usage; Pere et al., 1997). When the litter size or number of embryos in the uterus increased, nutrient availability per fetus would have been reduced. Consequently, BW of individual piglets from sows with smaller NBA would have been heavier than piglets from sows with larger NBA.

Trends for WW and ADG were similar across FPB litter groups. Sows in LG1 had the highest LSM for WW (7.35 ± 0.08 kg) and ADG (234.51 ± 3.05 g/d), and then declined towards LG4 (7.05 ± 0.06 kg and 223.95 ± 1.91 g/d) and LG5 (7.03 ± 0.09 kg and 222.59 ± 3.57 g/d). Male piglets had larger WW (7.75 ± 0.05 kg vs. 7.03 ± 0.05 kg; P < 0.001) and higher ADG (250.31 ± 2.09 g/d vs. 223.73 ± 1.95 g/d; P < 0.001) than female piglets. Male piglets likely were more aggressive, sucked more milk, and grew faster than female piglets (Colson et al., 2005). Thus, WW and ADG of piglets in litters that had more males were higher than those in litters that had more female piglets.









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FINAL REMARKS

- *Proportion of female piglets born alive (FPB) was a significant source of variation for NBA, BW, WW and ADG in Pietrain*
- *The highest NBA occurred in LG3 sows (40 % < FPB ≤ 60 %), and it decreased when FPB < 40 % or FPB > 60 %*
- *The lowest piglet BW was found in LG3 sows (40 < FPB ≤ 60 %), and it increased when FPB < 40 % or FPB > 60 %*
- *Trends for piglet WW and ADG were similar and decreased as FPB increased from LG1 to LG5 sows*