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Variability of birth weight and growth of piglets in highly prolific sows

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Abstract

The aim of this study was to determine the variability of birth weight and growth of piglets in hyper prolific sow line. Data collected from 25 litters from Pen Ar Lan Naima sow line were used to evaluate the variability of piglets' birth weight and its consequences on subsequent growth performances. All piglets were individually weighted five times from the birth until the end of nursery period. Pre-weaning mortality was the highest in piglets with birth weight less than 1,000 g. The difference in the final live weight at the end of nursery period between the lightest and heaviest piglets was more than 10 kg. Birth weight of piglets had a significant influence on pre-weaning mortality and subsequent growth performances. In large litters produced by highly prolific sows, the variability of birth weight of piglets together with an increased number of lighter piglets become a new challenge for pig producers.

Keywords: birth weight, daily gain, growth, litter size, parity, piglets, pigs, sex, sows

Introduction

Litter size and birth weight are important traits in pig production. Selection for improved litter size has resulted in an increase of a number of piglets born alive, and creation of highly prolific sow lines (Wolf et al., 2008; Luković and Škorput, 2015). However, improvement at birth is not completely realized at weaning due to a higher postnatal mortality (Quiniou et al., 2002). The number of piglets weaned per sow is a trait of major economic importance in pig production (Lund et al., 2002). At least partly, mortality during lactation is related to the decrease of average piglets' birth weight. Birth weight is the result of the intrauterine growth of piglets and is considered to be one of the most important factors influencing pig survival (Wolter et al., 2002; Deen and Bilkei, 2004). But a whole litter of the sow, the distribution of the birth weight within the litter (mean birth weight and variability within the litter) is of importance for the overall productivity of the sow (Bee, 2007; Wolf et al., 2008). Litters with high levels of birth weight variation are claimed to have reduced survival because direct competition excludes light littermates from access to functional and productive teats (Milligan et al., 2001). As birth weight decreased pigs were more likely to suffer mortality prior to weaning and during the nursery phase (Fix et al.,

2010). Not only survival rate but also postnatal growth performance can be compromised by low birth weight (Bee, 2007; Vaclavkova et al., 2012). Piglets' birth weight and uniformity of litter are also affected by parity (Milligan et al., 2002), and sex of piglets (Skorjanc et al., 2007).

The aim of this study was to determine the variability of birth weight and growth of piglets in hyper-prolific sow line in one of the top commercial pig farms in Croatia.

Materials and methods

The experimental herd consisted of 25 Pen Ar Lan Naima sows farrowed between December 2014 and January 2015. Gestating sows were moved to the farrowing rooms one week before the expected parturition day. Sows were treated with d-cloprostenol on day 112 of gestation period (Jančo et al., 2016). Each pen was equipped with a commercial crate. One infrared heat lamp was placed in each farrowing crate to provide additional heat to piglets. On average, piglets were weaned at 28 days. From the 5th day after farrowing until weaning, sows were fed *ad libitum*. Within the first 18 hours of life, piglets were individually weighted, teeth clipped, and tail docked, as well as individually identified and determined by sex. The third day after farrowing, piglets were injected with iron. Litter size was equalized by cross-fostering within two days after farrowing by moving piglets of smaller birth weight. Male piglets were castrated on the third day of life. During the survey, 360 piglets (Naima sows x P76 Pen Ar Lan hybrid boars) from 25 litters were weighted five times: the 1st day after farrowing (BW), 14th day of life (W2), at weaning on 28th day (W3), 30th day of nursery period (W4), and at the end of nursery period when piglets were old 83 days (W5).

Normality of birth weight (BW) was tested using PROC UNIVARIATE (SAS, 2009). Standard deviation (SD) and range were measures of the variability of the birth weight (BW) and other weight measures. The coefficient of variation (CV) related the variability to the mean. Minimal and maximal birth weight showed the extremes in the distribution. Analysis of variance and testing of main effects in the model for live weight at weaning (W3) was performed using PROC GLM (SAS, 2009). The statistical model included effects with levels: birth weight (BW), litter size (NBA), parity (PAR), and sex of piglets. For analysis purposes, BW was categorized into five classes: ≤1,000 g, 1,001 – 1,200 g, 1,201 – 1,400 g, 1,401 – 1,600 g, and ≥1,600 g. Litter size is presented as a number of piglets born alive (NBA), and categorized into three groups: <14 NBA, 14 – 16 NBA, >16 NBA. According to parity number (PAR), sows were divided into two groups: sows from the 1st to 3rd parity (PAR1), and sows from the 4th to 6th parity (PAR2).

Results and discussion

Numbers of piglets per BW class are presented in Table 1. Pre-weaning mortality averaged 17.2% of piglets born alive, which is slightly higher than the value obtained by Quiniou et al. (2002). In BW class below 1,000 g, almost 44% of piglets died during the lactation period, mainly between the first (BW) and the second weighing (W2), as presented in Table 2. These findings are in line with Fix et al. (2010), who

stated that most pre-weaning mortality occurs early in lactation. With the exception of crushing of piglets by the sow, early life mortality is most likely attributable to insufficient colostrum consumption and less milk consumption.

Table 1. Evolution of survival by birth weight (BW) class

BW class	BW range (g)	Number of piglets	Survival at weaning (%)
1	≤1,000	57	56.1
2	1,001 – 1,200	59	81.4
3	1,201 – 1,400	96	84.4
4	1,401 – 1,600	79	92.4
5	≥1,601	69	92.7

Variability of birth weights (BW) was largest in piglets with BW less than 1,000 g (Table 2). The highest number of piglets belongs to BW class between 1,201 and 1,400 g. Piglets with BW less than 1,200 g do not achieve critical live weights of minimum 7 kg at weaning, which means they need prolonged lactation period.

Values for birth weight at weaning (W3) in piglets belong to the first two BW classes were lower than those obtained in the study by Vaclavkova et al. (2012). The difference in the final live weight at the end of nursery period between the lightest and the heaviest piglets was more than 10 kg.

From all sources of variation (Table 3) included in the statistical model for live weight at weaning (W3), birth weight had the most important effect ($P<0.0001$). Parity and litter size showed the moderate level of significance (0.05 and 0.03). Effect of sex on weaning weight was not determined in this study ($P=0.67$), what is in agreement with the result of Bocian et al. (2012), although female piglets in this study had higher birth weight than male piglets.

Table 2. Variability of body weight by birth weight (BW) classes

BW range (g)	Trait	N	Mean (kg)	SD	Min	Max	CV (%)
<1,000	BW	57	0.78	0.15	0.4	0.99	19.78
	W2	34	2.68	0.69	0.91	4.08	25.72
	W3	32	5.79	1.14	3.83	8.25	19.68
	W4	31	11.34	1.66	8.1	14.8	14.61
	W5	31	21.99	3.49	15.4	29.5	15.87
1,001 – 1,200	BW	59	1.12	0.06	1	1.2	5.41
	W2	48	3.31	0.73	1.7	5.01	22.04
	W3	48	6.38	1.32	4.2	9.5	20.74
	W4	48	12.44	2.14	7.1	17.5	17.23
	W5	48	24.51	4.25	15.5	33	17.34
1,201 – 1,400	BW	96	1.31	0.06	1.21	1.4	4.32
	W2	83	3.75	0.86	1.36	5.26	22.83
	W3	81	7.08	1.39	4.02	10.15	19.64
	W4	80	13.63	2.24	7.9	18	16.44
	W5	80	27.29	3.95	15.8	35.5	14.48
1,401 – 1,600	BW	79	1.51	0.06	1.41	1.64	4.03
	W2	73	4.3	0.8	2.13	6.06	18.66
	W3	73	7.76	1.43	4.22	10.8	18.48
	W4	73	14.84	2.26	10.1	19.8	15.2
	W5	73	29.68	4.22	19.4	42	14.23
>1,600	BW	69	1.79	0.14	1.61	2.22	8.12
	W2	65	4.55	0.88	1.96	6.16	19.4
	W3	64	8.09	1.38	4.2	10.61	17.08
	W4	64	16.15	2.61	8.64	22.5	16.19
	W5	64	32.3	4.79	18.5	41.5	14.83

*N – the number of piglets at weighing, SD – standard deviation, CV – coefficient of variation

Table 3. The significance of main effects in the model for live weight at weaning

Source	DF	Sum of square	Mean Square	F value	P value
Sex	1	0.3116	0.3116	0.17	0.6794
Parity	1	6.7918	6.7918	3.73	0.0544
Litter size	2	12.7843	6.3921	3.51	0.0312
Birth weight	4	164.1609	41.0402	22.54	<0.0001

*DF – degrees of freedom

Conclusions

Birth weight of piglets had a significant influence on pre-weaning mortality and subsequent growth performances. In large litters produced by highly prolific sows, a variability of birth weight of piglets, together with an increased number of lighter piglets, become a new challenge for pig producers. Advantages in litter size of highly prolific sows could be only useful if mortality of piglets reduced and if appropriate growth performance in piglets will be assured.

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