VETERINARSKI ARHIV 82 (4), 319-326, 2012

Sow parity, body length, postural changes and piglet crushing

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OSTOVIĆ, M., Ž. PAVIČIĆ, A. TOFANT, A. EKERT KABALIN, S. MENČIK, D. POTOČNJAK, B. ANTUNOVIĆ: Sow parity, body length, postural changes and piglet crushing. Vet. arhiv 82, 319-326, 2012.

ABSTRACT

In the present study the association between sow parity, body length, frequency of posture changes and the rate of piglet crushing was investigated. The study was conducted at a pig farm farrowing unit and included 76 Seghers hybrid sows divided into three groups: parity 1 (n = 25), parity 3 (n = 27) and parity 5 (n = 24). Study sows were accommodated individually in farrowing crates of the same dimensions, in commercial conditions. The sow body length was measured upon accommodation in the farrowing crate. The frequency of sow posture change was observed within a 4 - hour period on lactation days 1, 10 and 20. Piglet death due to crushing was diagnosed by postmortem analysis. The sow body length increased with parity ($P<0.001$) and a high positive correlation between the sow parity and body length was recorded ($P<0.05$). The rate of sow posture change decreased with parity and increased with the time of lactation. On all days of lactation observed a high negative correlation was determined between the number of sow posture changes and parity, whereas between the number of sow posture changes and body length there was a significant to high negative correlation ($P<0.05$ all). Between the number of crushed piglets and other investigated parameters no significant correlation was found. Accordingly, the increasing body length in multiparous sows resulted in lower frequency of postural changes, while exerting no impact on the rate of piglet crushing.

Key words: sow, parity, body length, postural change, piglet crushing

Introduction

Farrowing crates are the most common type of accommodation for lactating sows and their litters in intensive production. The system was developed in the 1960s to reduce

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ISSN 0372-5480
Printed in Croatia

the high rate of piglet mortality, to rationalize room utilization, and to reduce the need for care and the cost of pig breeding (PUPPE et al., 2008). However, in spite of using farrowing crates, the rate of piglet mortality due to crushing by the sow has continued to contribute significantly to the overall piglet mortality (WEARY et al., 1996; WEARY et al., 1998; JARVIS et al., 2005) as a major economic and animal welfare problem (WISCHNER et al., 2009; OSTOVIĆ et al., 2010). KUNZ and ERNST (1987) report that piglet crushing accounts for 47.4% of all causes of deaths in live born piglets, and KRSNIK et al. (1996) that piglet crushing accounts for 37.8% of all piglet losses during the suckling period.

Piglet crushing is caused by sow posture changing, mostly by the crated sow lying down (DAMM et al., 2005). Yet, what appears to be critical is the amount of control that the sow exerts over the final stage of lying down, when the hindquarters make contact with the floor (JOHNSON and MARCHANT-FORDE, 2009).

Although piglet crushing should be prevented by accommodation in a farrowing crate through restricting sow movement, the lack of room in crates can have an unfavorable effect on sow posture changes, causing sudden hindquarter drop and piglet crushing (LOU and HURNIK, 1994; MILLS et al., 2010). Farrowing crate dimensions are generally based on the sow's static spatial requirements, including room for physical body accommodation, whereas dynamic spatial needs, including adequate room for body posture changes without obstruction by the crate, are mostly disregarded (CURTIS et al., 1989; LOU and HURNIK, 1994). Alongside this drawback, the increase in sow body size with increasing parity (McGLONE et al., 2004; O'CONNELL et al., 2007) poses an additional problem, since sows are eliminated from production after their 4th and 5th parity on average in intensive pig breeding (AKOS and BILKEI, 2004).

In the present study the correlation between sow parity, body length, the number of body posture changes and the number of crushed piglets was observed.

Materials and methods

The study was carried out at a pig farm farrowing unit in autumn during an average 27 - day production cycle and included 76 Seghers hybrid sows divided into three groups: parity 1 (n = 25), parity 3 (n = 27) and parity 5 (n = 24). The mean (± SD) number of piglets born alive *per* sow was 10.45 ± 1.23. Each sow was accommodated with the litter in commercial conditions, in a farrowing crate of the same dimensions, with a partially slatted concrete floor. The length of the crate was 1.80 m, the width of the parallel bars for the sow 0.56 m, and the width of the crate accessible by the piglets 0.35 m and 0.75 m, with a heater. The microclimate conditions in the farrowing unit were appropriate for this phase of production.

The length of sow body from the atlanto-occipital connection to the base of the tail (SOFTIĆ et al., 2004) was determined by use of a measuring tape upon their accommodation

in the farrowing crates. The frequency of sow posture changes was recorded on days 1, 10 and 20 of lactation. Ten sows were randomly chosen from each group and their postural behavior was recorded by digital video cameras (Toshiba Camileo P30 digital camcorders) for 4 hours (from 9.00 a.m. to 1.00 p.m.). Study sows were free from visible bodily lesions that could influence the frequency of their posture changes. Postural changes (lying on the left and right side, prone, sitting and standing positions), as described by GÖTZ (1991), were recorded by analysis of camera images. Piglet death due to crushing was diagnosed on the basis of bodily injuries and visible contusions with characteristic pathomorphological lesions (subcutaneous hematomas and hemorrhage in body cavities). In addition, some carcasses were flattened, with the tongue protruding from the mouth.

Statistical analysis was performed by use of Statistica v. 9 software (StatSoft Inc.). Basic data processing was performed by use of descriptive statistical methods and normality of data distribution was verified by the Kolmogorov-Smirnov test. The significance of differences in the study parameters among the three groups of sows was determined by analysis of variance. One-way ANOVA with the Tukey unequal n HSD test for post-hoc analysis was employed for parameters with normal distribution (sow body length and postural changes), while Kruskal-Wallis ANOVA was used to analyze the number of crushed piglets. The frequency of posture changes within a particular groups of sows on days 1, 10 and 20 of lactation was analyzed by the Repeated Measures ANOVA. Correlation between parameters was determined by linear correlation for the parameters with normal distribution, while Spearman Rank Order correlation was employed for the number of crushed piglets.

Results

The results of sow body length, the number of postural changes and the number of crushed piglets in parity 1, parity 3 and parity 5 sows, and the correlations of study parameters are shown in Tables 1, 2 and 3.

As shown in Table 1, an increase in body length was recorded in all groups of sows ($P<0.001$), along with a high positive correlation between sow parity and body length ($P<0.05$) (Table 3).

The number of postural changes on days 1, 10 and 20 of lactation decreased with the increasing sow parity in all groups, yielding a significant difference ($P<0.05$), with the exception of parity 3 and parity 5 sows on lactation day 10 (Table 2). A high negative correlation was found between sow parity and the number of postural changes on all days of lactation observed ($P<0.05$) (Table 3). As shown in Table 2, the frequency of postural changes increased with the length of lactation. The number of postural changes differed significantly between days 1 and 20 of lactation in parity 1 and parity 5 groups, whereas the parity 3 group had a greater number of postural changes on day 20 as compared with

lactation days 1 and 10 (P<0.05 all). Between all days of lactation observed a significant positive correlation was found in relation to the rate of sow postural changes (P<0.05) (Table 3). Also, on all three days of lactation observed a significant to high negative correlation was recorded between the number of sow posture changes and body length (P<0.05) (Table 3).

Table 1. Sow body length and number of crushed piglets according to parity

Parity	Sow body length (cm) Mean ± SD	Crushed piglets (n) Median (min - max)
1 (n = 25)	121.18* ± 3.80	0 (0 - 2)
3 (n = 27)	134.82* ± 4.02	0 (0 - 2)
5 (n = 24)	141.97* ± 2.33	1 (0 - 2)

*Values in the same column statistically significantly different at the level of P<0.001

Table 2. Frequency of sow postural changes in a 4 - hour period on lactation days 1, 10 and 20 according to parity

Parity	Sow postural changes (n) Mean ± SD		
	Day 1	Day 10	Day 20
1	26.70[a] ± 1.42	28.90 ± 1.79	31.40[a] ± 2.12
3	22.70[a] ± 3.37	25.20*[,b] ± 1.69	28.60[a,b] ± 1.78
5	19.90[a] ± 2.18	23.10* ± 2.28	25.70[a] ± 2.98

n = 10 sows *per* group; all values in the same column statistically significantly different at the level of P<0.05, with the exception of those marked with asterisk*; [a,b]values in the same row marked with the same letter in superscript statistically significantly different at the level of P<0.05

Table 3. Correlation between sow parity, body length, postural changes and crushed piglets

		Parity	Sow body length (cm)	Sow postural changes (n)			Crushed piglets (n)
				Day 1	Day 10	Day 20	
Parity		1.00	0.91*	- 0.76*	- 0.78*	- 0.72*	0.23
Sow body length (cm)			1.00	- 0.63*	- 0.81*	- 0.68*	0.19
Sow postural changes (n)	Day 1			1.00	0.64*	0.51*	- 0.13
	Day 10				1.00	0.49*	- 0.30
	Day 20					1.00	0.07
Crushed piglets (n)							1.00

*statistically significant (P<0.05)

There was no significant difference in the rate of piglet crushing according to sow parity (Table 1). Between the rate of piglet crushing and sow parity as well as other

investigated parameters, i.e. sow body length and postural changes, no significant correlation was found (Table 3).

Discussion

Spatial restriction and reduced sow mobility in farrowing crates can result in a lack of comfort manifested in restlessness, frequent postural changes, and thus a higher rate of piglet crushing (NOWICKI and SCHWARZ, 2010). Besides the farrowing crate size, the frequency of sow postural changes can also be influenced by the farrowing unit microclimate and type of crate floor (PAVIČIĆ et al., 2006), along with associated pathology, such as shoulder ulcers in sows (HAUSSMANN et al., 1999).

The frequency of postural changes is also parity dependent. Results reported by LI and GONYOU (2007) reveal that it decreases with growing parity. The results of this study are consistent with their report (Tables 2 and 3) and could be ascribed to the increasing sow body length with higher parity (Tables 1 and 3) and to the demonstrated negative correlation between the sow body length and the number of posture changes (Table 3).

The frequency of sow posture changes increases with the duration of lactation (VALROS et al., 2003; TANAKA and KOKETSU, 2007), as also confirmed in our study (Tables 2 and 3). KRSNIK et al. (1997) attribute it to different piglet positions according to age and physiological maturation.

The majority of piglet crushing cases occur within the first few days of birth (CARR, 2006; ALONSO-SPILSBURY et al., 2007). A higher rate of piglet crushing is recorded in multiparity sows due to their larger litter sizes (FRENCH et al., 1979; UREMOVIĆ et al., 2009). According to WEARY et al. (1998), the higher rate of piglet crushing in multiparity sows with larger litter sizes is associated with lower piglet daily gain. For this reason, weaker piglets spend more time close to the sow for suckling, thus being more exposed to possible crushing. In addition, these authors speculate on the higher rate of piglet crushing in multiparity sows to be possibly due to their higher body weight and clumsiness. The greater sow body size, including body length, reduces their physical body control in the spatially restricted farrowing crate, resulting in a higher rate of piglet crushing (LAY et al., 2002). In the present study, there was no significant correlation between the number of crushed piglets and sow body length, as well as parity and postural changes (Table 3) and could be explained by individual differences in the maternal behavior of the sows (WECHSLER and HEGGLIN, 1997).

In conclusion, increasing body length in multiparity sows results in lower frequency of postural changes but does not influence the rate of piglet crushing. However, since in commercial production both parity 1 and multiparity sows are housed in farrowing crates of the same dimensions, this husbandry practice could be detrimental for their comfort. Namely, frequent postural changes as well as reduced postural changes may both reflect a

lack of comfort in the sows (ANIL et al., 2006). Therefore, sow parity should also be taken in consideration when designing farrowing crates to accommodate the size of the sows and make them more comfortable.

Acknowledgements

Supported by the Ministry of Science, Education and Sports of the Republic of Croatia (grants nos. 053-0532265-2242 and 053-0532265-2238).

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Received: 29 June 2011
Accepted: 17 April 2012

OSTOVIĆ, M., Ž. PAVIČIĆ, A. TOFANT, A. EKERT KABALIN, S. MENČIK, D. POTOČNJAK, B. ANTUNOVIĆ: Redni broj prasenja, duljina tijela, promjene položaja krmača i prignječenje prasadi. Vet. arhiv 82, 319-326, 2012.

SAŽETAK

U radu je istraživana povezanost između rednog broja prasenja, duljine tijela, učestalosti promjena položaja krmača i broja prignječene prasadi. Istraživanje je provedeno u prasilištu svinjogojske farme i uključilo je 76 krmača Seghers hibrida, podijeljenih u tri skupine, prvopraskinje (n = 25), trećepraskinje (n = 27) i petopraskinje (n = 24). Svaka od krmača bila je smještena u komercijalnim uvjetima, prasilišnom odjeljku istih dimenzija. Duljina tijela krmača određivana je nakon smještaja u prasilišni odjeljak. Učestalost promjena položaja krmača praćena je unutar 4-satnog razdoblja 1., 10. i 20. dana laktacije. Dijagnoza uginuća prasadi uslijed prignječenja postavljena je na osnovi postmortalne analize. Duljina tijela krmača povećavala se s rednim brojem prasenja ($P<0,001$) i između rednog broja prasenja i duljine tijela krmača utvrđena je visoka pozitivna povezanost ($P<0,05$). Broj promjena položaja krmača opadao je s rednim brojem prasenja, a povećavao s vremenom laktacije. Tijekom svih promatranih dana laktacije između broja promjena položaja i rednog broja prasenja krmača utvrđena je visoka negativna povezanost, a između broja promjena položaja i duljine tijela krmača značajna do visoka negativna povezanost ($P<0,05$ sve). Između broja prignječene prasadi i drugih istraživanih pokazatelja nije utvrđena značajna povezanost. Može se zaključiti da porast duljine tijela u višepraskinja dovodi do manje učestalosti promjene položaja, a ne utječe na broj prignječene prasadi.

Ključne riječi: krmača, redni broj prasenja, duljina tijela, promjena položaja, prignječenje prasadi