Effect of alternative farrowing pens with temporary crating on the performance of lactating sows and their litters

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분만돈 대체사육시설이 모돈과 자돈의 생산성에 미치는 영향

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Abstract

This study was performed to development the alternative farrowing pen (AFP) and to investigate performance of lactating sows and their litter. A total of 64 multiparous sows were randomly divided into two groups and were allocated to farrowing crates (FCs) and AFPs. The AFPs contained a crate and support bars that could be folded to provide the sows with extra space on day 5 postpartum. Farrowing systems did not affect feed intake, back-fat thickness, litter size and piglet weight at birth and weaning ($p > 0.05$). In addition, there were no differences in the number of crushed piglets between the two farrowing systems ($p > 0.05$). However, the weaning-to-estrus interval was shorter in the sows of the AFPs than in thous of the FCs ($p < 0.05$). It is concluded that the AFPs with temporary crating until day 4 postpartum did not negatively affect performance and crushed piglet compared with the FCs. It also may improve animal welfare by allowing sows to move and turn around during the lactating period. Further research is needed to find suitable housing designs to enhance productivity and animal welfare.

Keywords: Alternative farrowing pen, Animal welfare, Lactating sows, Piglets, Temporary crating

1. Introduction

Farrowing crates (FCs) are widely used in the swine industry to reduce the number of crushed piglets during the lactation period. However, FCs raises serious welfare concerns that they restrict the sow's physical movement and normal behavior, resulting in frustr-ation and stress [1-4]. Recently, due to increasing public pressure to abolish FCs, loose farrowing systems (LFSs) have been introduced to improve sow and piglet welfare via different design features [5-7], compared to FCs such as reduced confinement and a greater amount of space. Sows in LFSs allow sows to turn around and interact more with their litters through providing more space. However, the important economic and welfare problem of pre-weaning piglet mortality in LFSs remains. Crushing is one of the major causes of pre-weaning piglet mortality, alongside starvation [8-12]. Pi-glets are most vulnerable until the first 4 days after birth, with more than 50%-80% of deaths occurring during this period [12-15]. Over the years, many researchers have endeavored to reduce the number of crushed piglets by sows by installing support devices, such as anti-crushing bars in LFSs [16,17]. Several studies have found no significant impact on piglet crushing mortality in LFSs because the sows lie down and roll over in the open area [18,19]. Attempts have been made to improve animal welfare for lactating sows and their litters, including circular, ellipsoid, rectangular, hinged crates and temporary crating systems. Nevertheless, these facilities are hard to install and manage in industrial swine farms.

Therefore, this study was performed to development the alternative farrowing pen (AFP) and to investigate the performance of lactating sows and their litter.

2. Materials and Methods

2.1 Animals and management

The experiment was conducted on a commercial farm in Korea under mild weather (from October to November). A total of 64 multiparous sows (Yorkshire × Landrace) were randomly divided into two groups and were allocated to FCs and AFPs on day 7

prepartum from the expected farrowing day. All sows were familiar with FCs. On day 5 postpartum, the crates were opened to provide the sows with extra space in AFPs. All sows were fed a standard ration of commercial concentrate twice a day at 0700 and 1600 h (Table 1) and had *ad libitum* access to water. The management routine and handling of sows and piglets were performed based on the normal practices of the farm. The air temperature varied from 7.4 ± 3.4℃ to 23.0 ± 3.9℃, and the relative humidity was 66.7 ± 10.1%. An infrared lamp (250 W) was installed above the creep area, and it was turned on when the farrowing room temperature was below about 29°C during the 5 days postpartum. Ventilation was automatically controlled by fans. Some piglets were cross-fostered immediately after parturition so pens or crates would contain no fewer than nine and no more than twelve piglets.

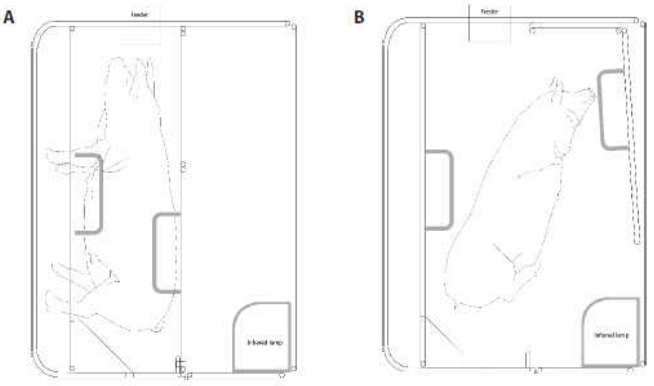
2.2 Housing design

Figs. 1 and 2 show photographs and schematics of the farrowing pens with the crate closed (A) and opened (B). AFPs (210 × 180 cm) contained a crate (210 × 65 cm) and support bars to prevent the piglets from being crushed by the sows. These bars were flexible and could be easily folded to open the crates and provide the sows with more space (210 × 165 cm) than in the previous systems equipped with the swing-side crates. Thus, the sows could not only turn around but also move freely. Drinkers were located inside the feed trough at the front of the crates. All floors were slatted with triangular steel bars, and no nesting materials were supplied.

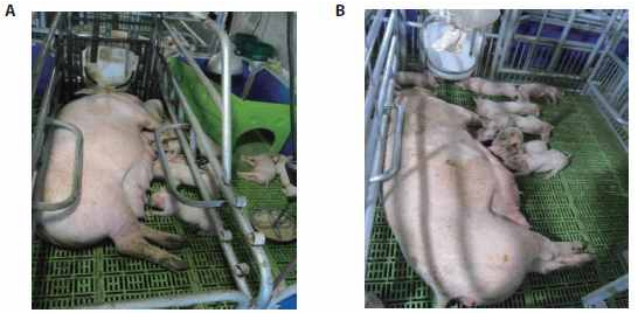
[Table 1] Composition of diets fed to lactating sows (%)

Ingredient	Lactation
Corn	52.39
Soybean meal	29.00
Wheat	7.83
Wheat barn	2.00
Tallow	5.00
Lysine (95%)	0.20
Methionine (50%)	0.05
Limestone	0.83
Tricalcium phosphate	1.90
Salt	0.30
Vitamin-mineral mix1)	0.40
Antibiotics	0.10
Total	100.00
Chemical composition	
ME (kcal/kg)	3386.00
Protein	18.60
Lysine	1.19
Methionine	0.31
Calcium 0.90	0.90
Phosphorus	0.73

1) Composition per kg of mix: 2,750,000 IU vitamin A, 220,000 IU vitamin D3, 1,450 mg riboflavin, 11,000 mg d-pantothenic acid, 11,000 mg niacin, 110,000 mg choline, 11 mg vitamin B12, 1,100 mg menadione, 2.2 g ethoxyquin, 11,000 IU vitamin E; Contained 20% Zn, 10% Fe, 5.5% Mn, 1.1% Cu, 0.15% I.



[Fig. 1] Schematics of the alternative farrowing pen. (A) closed the crate (installed support bar), (B) opened the crate (removed support bar).



[Fig. 2] Photographs of the alternative farrowing pen. (A) closed the crate (installed support bar), (B) opened the crate (removed support bar).

2.3 Performance

Leftover feed was removed every morning before new feed was offered. Feed intake was determined as the difference between the allowance and leftover feed collected the next morning. The back-fat thickness was measured ultrasonically (SSD-500V, Aloka, Wallingford, CT, USA) on each sow before farrowing and at weaning at the last rib and 65 mm from the dorsal midline [20,21]. The weights of suckling piglets were measured on day 1 and 21. A veterinarian monitored the deaths of piglets by crushing and disease through daily inspections, and the number of crushed piglets was recorded every day. Estrus checks for all sows were conducted twice daily using intact boars from 3 days after weaning until the end of estrus. The occurrence of estrus was defined by the standing reflex in front of a boar and the reddening and swelling of the vulva. Litter weight and litter size were recorded on the day of birth after cross-fostering and on the day

of weaning.

2.4 Statistical analysis

Parity, feed intake, back-fat thickness, weaning-to-estrus interval, litter size, birth weight, and weaning weight were statistically analyzed using the SAS GLM procedure (SAS Inst., Cary, NC, USA). These data were approximately normal and were thus analyzed without transformation. Chi-squared analysis [22] was used to determine significant differences in the crushing of suckling piglets by sows.

3. Results and Discussion

3.1 Performance

There were no differences in feed intake, back-fat thickness, weaning-to-estrus interval, piglet birth weight, or piglet weaning weight between the FC and AFP systems ($p > 0.05$, Table 2).

In this study, the weaning-to-estrus interval was shorter in AFP sows (4.3 ± 0.5 days) than in FC sows (5.1 ± 1.0 days) ($p < 0.05$).

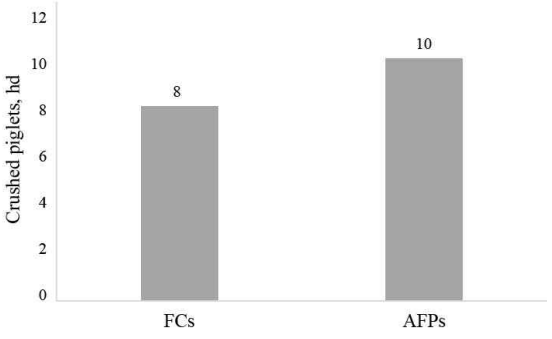
Sow milk yield was not measured in this study, but we assumed that sows did not differ in milk yield because there was no difference in average birth weight or weaning weight between FC and AFP piglets.

The total number of crushed piglets did not differ between FC and AFP piglets (Fig. 3, $p > 0.05$). Sows normally spent most of their time lying on their sides in the first 24 h postpartum, after which they made more posture changes, which can lead to a greater risk of crushing [23–25]. FCs result in high piglet mortality for other reasons, although there were fewer crushed piglets in FCs than in LFSs [26]. In this study, we found that FCs prevented crushing death and also restricted sows' movement after 4 days postpartum.

[Table 2] Effects of the AFP on the performance (mean ± SD) of sows and litters

Variables	Type of farrowing system		*p*-value
	FC	AFP	
Sow			
No. of sows	32	32	
Parity	4.5 ± 2.53	4.4 ± 2.5	ns
Feed intake (kg/d)	6.39 ± 0.47	6.39 ± 0.86	ns
Backfat thickness (mm)			
Before farrowing	15.7 ± 4.5	16.5 ± 4.7	ns
At weaning	14.2 ± 3.9	14.1 ± 4.3	ns
Backfat thickness loss	−2.1 ± 3.1	−2.5 ± 3.8	ns
Weaning to estrus interval	5.1 ± 1.0[a]	4.3 ± 0.5[b]	< 0.001
Piglet			
Litter size (piglets/litter)			
At d 1 postpartum[1)]	10.1 ± 1.2	9.8 ± 0.9	ns
At weaning	9.0 ± 1.2	8.8 ± 1.5	ns
Average birth weight (kg)	1.5 ± 0.3	1.6 ± 0.3	ns
Average weaning weight (kg)	7.6 ± 1.2	8.1 ± 1.3	ns

[1)]After cross-fostering.
[a,b]Values within treatment (rows) with different superscripts differ significantly ($p < 0.05$).
AFP, alternative farrowing pen; FC, farrowing crate; ns, not significant ($p > 0.05$).



[Fig. 3] The number of crushed pigletsin the different farrowingsystems. FC, farrowing crate; AFP, alternative farrowing pen.

4. Conclusion

It is concluded that the AFPs with temporary crating until day 4 postpartum does not impact performance and crushed piglet, compared with the FCs. It also may improve animal welfare by allowing sows to move and turn around during lactating period. The AFPs are not only meet the animal welfare standards in Korea but also more efficient at providing sows with additional space in the same area than previous swing-side type. In addition, the support bar is very easy to deal with when the crates are opened. We therefore suggested that it seems feasible to utilize alternative farrowing systems on commercial farms. Moreover, further research is needed to find suitable housing designs to enhance productivity and animal welfare.

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