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Reproductive performance, offspring characteristics, and injury scores according to the housing system of gestating gilts

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ABSTRACT

The time of mixing is a key factor that influences the success of group housing system for gestating swine females. This study compared the effects of three gestation housing systems for gilts on body injuries, locomotion problems, farrowing rate and litter characteristics. The gilts were randomly assigned to 1 of the 3 treatments: STALL = gilts housed in individual stalls throughout gestation; PEN7 = gilts group-housed in pens at 7 d after breeding, and PEN30 = gilts group-housed in pens at 30 d after breeding. Farrowing rate was different ($P = 0.04$) between STALL and PEN7 (89.7% and 83.2%, respectively) whereas an intermediate farrowing rate was observed in PEN30 (84.9%). Treatment did not affect pregnancy maintenance from 28 d to 55 d after AI or from 28 d till farrowing and, as well, the parameters such as the total number of piglets born, born alive, birth weight, the coefficient of variation of birth weight within the litter, and the proportion of piglets weighing less than 1000 g also remained unchanged. The gilts in the STALL group had greater weight and gained more weight up to 107 d of gestation compared to those in PEN7 and PEN30 groups ($P < 0.001$). A greater chance of increased injury score for skin and claws was observed at 3, 12, and 23 d after housing in PEN7 and PEN30 than in STALL. At 107 d of gestation, PEN7 and PEN30 groups had greater odds for skin injuries, claw lesions, and lameness compared to STALL ($P < 0.001$). There was no increase in the chance of lameness in STALL but PEN7 and PEN30 groups had greater odds (122.2 and 76.4, respectively) of lameness ($P < 0.001$) at the end (4.9%, 39.2%, and 26.7%) than at the onset of gestation (3.1%, 0.5%, and 0.5% for STALL, PEN7, and PEN30, respectively). The culling rate as manifested by locomotor problems was found to be greater in PEN7 group than in PEN30 and STALL groups ($P < 0.001$). In conclusion, mixing gestating gilts at 7 d after breeding compromised farrowing rate; however, mixing gilts on day 30 post-breeding did not impair reproductive performance or litter characteristics. Regardless of the mixing time (7 or 30 d after breeding), more sow injuries (skin lesions and lameness) were observed in the ESF system compared to the individual housing in stalls.

1. Introduction

In the European Union, pregnant sows are group-housed from day 28 after breeding, allowing social interaction and expression of other natural behaviors (Harris et al., 2006). In the United States, gestation stalls are used on a large scale; however, there is pressure from animal welfare groups to restrict and/or ban their use (HSUS, 2013). The country intends to modify the housing system gradually through state legislations or initiative of private corporations (Knox, 2013). Brazil is the fourth largest pork producer in the world and houses its breeding sows predominantly in individual stalls. However, there is an increasing interest in knowing the effects of grouping on sow welfare and productivity.

Several factors have been shown to influence the performance of group-housed sows (reviewed by Verdon et al., 2015). Feed competition and aggressions increase the possibility of skin injuries (Jang et al., 2015) and locomotor problems (Jang et al., 2015; Karlen et al., 2007), which are the major animal welfare concerns in collective pens (Broom et al., 1995). Another concern is the performance of swine pregnant females when moved to collective pens. Although reproductive failures have been reported for swine females moved to collective housing system within 3–10 d after AI (Arey and Edwards, 1998; Knox et al., 2014), a reduction in farrowing rate was also reported in females that were group-housed at approximately 30 days of gestation (Jang et al.,

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2015). Thus, the best gestational time for mixing females to minimize its effect on reproductive performance is not well established.

The aim of this study was to determine whether measures of aggression (e.g. lesion and locomotion scores), reproductive performance and offspring characteristic differed between sows housed individually throughout gestation or mixed into groups on days 7 or 30 post-breeding.

2. Material and methods

The use of animals and all the experimental procedures were approved by the institutional committee for animal care and was carried out as prescribed by the Universidade Federal do Rio Grande do Sul, project number 26251. The study was performed from April to October, during the stocking of a farm with 2400 sows in Midwest of Brazil (Parallel 18°), a region with tropical climate, with average ambient temperatures varying from 13° to 29 °C. Sprinklers and fans were turned on when temperature within building exceeded 25 °C. No extra artificial illumination was provided.

2.1. Experimental design

The housing during the gestation in individual stalls was compared with a group-housing system in collective pens equipped with an electronic sow feeder (ESF - SowComp, WEDA Dammann & Westerkamp GmbH, Lutten, Germany). After first insemination, gilts were randomly allocated to one of three treatments (Fig. 1): STALL (n = 271) – gilts were maintained in individual stalls throughout the gestation; PEN7 (n = 220) – gilts were transferred to the group-housing system within 5–10 d (mean of 7.0 ± 1.90 d) after mating and maintained as a static group, and PEN30 (n = 220) –gilts were maintained in individual stalls until d 28–33 after mating (mean of 30.0 ± 2.40 d), and then they were transferred to the group-housing system. Prior to insemination all gilts were housed in individual stalls. In PEN30, only gilts having the pregnancy confirmed were group-housed in collective pens. The study was performed in 4 replications for each treatment. For the STALL group, the number of gilts included was 66, 50, 66 and 89 for replications 1–4, respectively.

2.2. Animals, housing, and feeding

Gilts of two genetic lines (Large White and Landrace; DB Agricultura e Pecuária, Patos de Minas, Brazil) were used in this study. Before the onset of the experiment, gilts (approximately 200 days of age) were housed in groups of approximately 25 gilts / pen. The floor was partially slatted, and the gilts had a floor space allowance of approximately 1.6 m^2/gilt. A boar was introduced in the pen once a day for 15 min, for estrus induction. During the boar stimulation period, gilts were fed thrice daily with a total of 3.0 kg of a standard corn-soybean diet (3.50 Mcal metabolizable energy, 19.5% crude protein, and 0.8% total lysine). At 7d after their first estrus (218.3 ± 0.48 d of age), gilts were transferred to stalls (0.6 × 2.2 m) with partially slatted floors, which had individual nipple drinkers and drop feeders. For 2 weeks, gilts were fed ad libitum (flushing) on a corn-soybean based diet (3.55 Mcal metabolizable energy, 19.5% crude protein, and 1.3% total lysine). At their second estrus, gilts were weighed and maintained in stalls, where they were artificially inseminated (AI) at the onset of estrus and at 24-h intervals until no longer standing in estrus. The semen doses containing 3.0×10^9 sperm cells diluted in Beltsville thawing solution (BTS, Minitüb GmbH, Tiefenbach, Germany) were stored at 15 °C and used within 48 h of storage. The boars of two genetic lines (Large White and Landrace; DB Agricultura e Pecuária, Patos de Minas, Brazil) were used in this study and the crossings were LW x L and L x LW.

Each group-housing pen had a feeder unit and 4 water drinkers. The floor was divided into two sections: 2/3 portion as solid and 1/3 as slatted. There were 55 gilts per pen provided with a floor space allowance of approximately 2.2 m^2/gilt. All the gilts were moved to farrowing crates at 107 d after AI.

After insemination, the gilts kept in stalls were fed individually once per day (8 a.m.), while those kept in the ESF system were tagged with ear transponders and automatically fed. The ESF system was kept on between 8 a.m. and 11 p.m., and the release of feed was triggered by a voluntary entrance of the animals. Gilts were fed 1.8 kg in the first 30 d of gestation and 1.6 kg from 31 to 70 d of gestation. Afterward, they received 2.0 kg with a 200-g weekly increase until reaching 3.0 kg/day; this amount was offered up to 107 d of gestation. The gestation feed was a corn-soybean based diet (3.24 Mcal metabolizable energy, 15.2% crude protein, and 0.8% total lysine). Throughout the experiment, water was provided ad libitum.

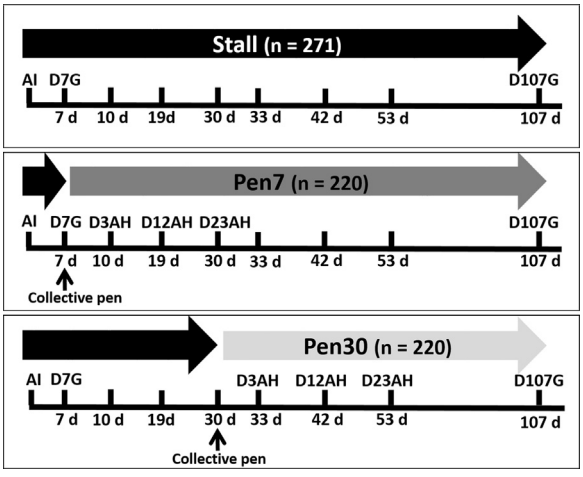

Fig. 1. The schematic representation of treatments and the evaluation of injury scores along the gestational period. STALL = gilts were maintained in stalls throughout gestation. PEN7 = gilts were moved to collective pens at 7 d after artificial insemination (AI). PEN30 = gilts were moved to collective pens at 30 d after AI. Lesion scores were determined at 7 (D7G) and 107 (D107G) d of gestation, and at 3 (D3AH), 12 (D12AH), and 23 d (D23AH) after housing in collective pens.

2.3. Measurements

The body weight of the gilts was measured at breeding, 65, and 107 d after AI. The backfat thickness (BFT) was measured at breeding and 107 d of gestation by ultrasonography (Piglog105, Carometec S.A., Soeborg, Denmark). The average of BFT was measured between 2 points (7 cm cranial and 7 cm caudal from the last lumbar vertebra).

The return to estrus was checked from 17 to 27 d after AI. For STALL and PEN30 groups, the gilts were checked once daily by the exposure to a mature boar. For PEN7, the gilts were exposed to a mature boar once a day for 10 min inside the pens. At 28 d after AI, the pregnancy status was determined by a real-time ultrasound examination using a transducer of 5.0 MHz (Multiscan MS Schippers, Schippers Export B.V Ltd., Eindhoven, Netherlands). A second pregnancy status was checked at 55 d after AI to evaluate the pregnancy maintenance from 28 d till 55 d after AI and from 28 d after AI until farrowing.

During farrowing, the numbers of total born, born alive, stillborn, and mummified piglets were recorded. The born alive and stillborn piglets were weighed at birth. The records of removal by locomotor problems or food intake interruption, as well as death, were kept throughout the experimental period.

2.3.1. Lesions scoring and leg assessment

The presence of lesions was assessed at approximately 7 d of gestation (D7G), before mixing the gilts. They were assessed again at 3, 12, and 23 d after housing, and at approximately 107 d of gestation (D107G), before the transfer to farrowing crates (Fig. 1). The occurrence and severity of lesions on the head (ears and face), neck,