The Effect of Rubber Flooring on Displaying Stereotypies in Gilts

Wirkung von Gummiliegeflächen auf das Auftreten von Stereotypien bei Jungsauen

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Summary

The aim of the study was to assess the effect of rubber mats in service unit on displaying stereotypes in gilts. Four 28-day production cycles in all seasons were observed. Each cycle included 28 gilts housed in gestation stalls with slatted concrete floor, which was covered with adjusted mats for 14 gilts (experimental group), while the remaining 14 gilts served as controls. Display of stereotypes and other behaviours observed, mat manipulation and postural behaviours were estimated by direct 1-hour observation of gilts at 2-minute intervals after morning feed supply on days 1, 8, 15 and 28 of each cycle. During the study period, displaying stereotypes was significantly less frequent (P <0.05) in experimental group as compared with control group. The rate of particular forms of stereotypes, i.e. vacuum chewing, bar biting and teeth grinding, was also significantly lower (P <0.05 all) in experimental group throughout the study period. A significant negative correlation (P < .05) was found between the service unit air temperature and frequency of displaying stereotypes in control group, which could be attributed to the significantly more common standing posture (P <0.05) in control gilts in the conditions of lower air temperature. During the cold period, experimental gilts took a lying position significantly more frequently (P <0.05). In the experimental group of gilts there was no significant correlation (P >0.05 all) between the frequency of displaying stereotypes and the frequency of lying and other postures observed, as well as between the stereotypy display and the air temperature. There was no significant correlation (P >0.05 all) between the frequency of mat manipulation and displaying stereotypes in total or its particular forms, suggesting that the less pronounced stereotypy display in experimental gilts may have been influenced by factors other than those observed in the present study.

Keywords: pig, soft surface, behaviour, welfare

Zusammenfassung

**Introduction**

Oral-nasal-facial behaviours may include functional behaviours such as feeding and drinking, or for instance rooting in pigs, but may also include stereotypic behaviours. Stereotypies are repetitive, unvarying behaviour patterns with no obvious goal or function (Mason, 1991; Broom and Fraser, 2007) that potentially indicate reduced welfare (McGlone et al., 2004). Nevertheless, stereotypies are important indicators that the environment is not providing sufficient opportunities for the animals to perform their normal behaviour (Keeling and Jensen, 2009).

Stereotypies develop consequentially to restrictive and barren environments, i.e. due to boredom, frustration and stress caused by unmet animal needs such as exploring and foraging, and can result in physical damage (Barnett et al., 2001). Stereotypies usually occur in animals on restrictive feeding: considering food-producing animals, most commonly in poultry and pigs (Mason and Mendl, 1997; Vučinić, 2006; Mills et al., 2010).

Pigs perform most stereotypies after feeding (Rushen, 1985), of which vacuum chewing, bar biting and drinker playing are most commonly reported (Sekiguchi and Koketsu, 2004; Broom and Fraser, 2007). In addition, the incidence of stereotypies in pigs increases with increasing confinement (von Borrel et al., 1997) and sow parity (Chapinal et al., 2010).

Although breeding females in commercial pig farming are mostly kept on concrete fully or partly slatted floors, these housing systems can endanger their welfare (Tuyt tens, 2005; Tuyttens et al., 2008). Therefore, enrichment of their environment is emphasised and rubber mats as a management tool are gaining interest. Previous studies have pointed to welfare benefits of using rubber mats in sows (Gravás, 1979; Boyle et al., 2000; Farmer et al., 2006; Zurbrigge, 2006; Devillers and Farmer, 2008; Tuyttens et al., 2008; Elmore et al., 2010), including increased lying comfort. Investigating behaviour of stalled breeding females at a commercial pig farm, Sekiguchi and Koketsu (2004) found prolonged lying to be associated with a lower rate of stereotypy display in gilts.

The aim of the present study was to determine whether and to what extent rubber mats influence the rate of stereotypy display in gilts.

**Material and Methods**

The study was conducted at a commercial pig farm service unit during production cycles in all seasons according to gilt availability, as follows: May–June (spring), September (summer), November (autumn) and December–January (winter). Each cycle lasted for 28 days, i.e. a period during which gilts are usually accommodated individually in service unit postmating according to the Council Directive 2008/120/EC.

**Animals**

The study included 112 Large White gilts, 28 animals per cycle, randomly divided in two equal groups. Control gilts were housed in gestation stalls (1.80 m L × 0.60 m W × 1.00 m H) with metal bars (horizontal bars only on the lateral sides of the stalls) and concrete slatted floor (slat width 8 cm, slot width 2 cm), which was covered with rubber mats (GumimpeX-GRP Inc., HR) in the experimental group. Mat depth is 2 cm, while mat length, width and slots were adjusted to the stall size and floor slots. Treading surface of the mat is of uneven, stopper-like configuration. Mats were connected with the so-called puzzle system and tightened to the concrete floor. Upon completion of a cycle, the mats were dismantled, cleaned, disinfected, and then placed again before the next cycle.

In the service unit, gilts were fed concentrated feed in the amount of 2.20 kg/day twice (07:30 and 13:00) from the same troughs used for watering ad libitum. Concentrated feed is supplied via volume dosing system and water by use of water level control that ensures constant water level in the trough. Lighting in the service unit is combined, natural and artificial, provided for at least eight hours. Ventilation is mechanical, based on negative pressure. Fresh air is supplied to the unit through ventilation apertures along the unit roof. Contaminated air is eliminated from the unit via roof ventilators. In cold months, there is no heating; acceptable microclimate conditions are achieved by reduced ventilation.

According to the above mentioned Council Directive 2008/120/EC, pigs must have permanent access to a sufficient quantity of material to enable proper exploration and manipulation activities, such as straw, hay, wood,
sawdust, mushroom compost, peat or a mixture of such. As the aim of the study was to assess stereotypy display according to postural behaviour of the gilts and association of stereotypies with mat manipulation, no such material was available to the animals due to the possible material interference with study results.

Prior to entering the service unit, gilts were kept in a breeding facility in a group pen (6.25 m L × 4.80 m W × 1.20 m H) with concrete slatted floor (slat width 8 cm, slot width 1.80 cm) and full PVC fence, capacity 30 animals. Feed and water were offered ad libitum (concentrated feed, box feeders, nipple drinkers). Because of the slatted floor in breeding facility, gilts are usually not supplied with the above mentioned material for manipulation and exploration, but their environment is enriched with various objects (e.g., rope) that do not compromise their health.

Oestrus synchronization and insemination of gilts was previously performed for all study gilts to enter the service unit at the same time. Pregnancy was diagnosed by ultrasound at the usual time during the fourth week of their stay in the service unit.

Stereotypy display was assessed on days 1, 8, 15 and 28 of each cycle. Stereotypies were evaluated by the same trained observer by direct observation of gilts for 1 hour, starting from the morning feed distribution, as described by Vieuille-Thomas et al. (1995) and Estienne et al. (2006). The observer walked quietly along the stalls and recorded stereotypies in 2-minute intervals. On calculating the overall number of stereotypies displayed (n), any form of stereotypy display was equally evaluated, i.e. displaying the same type of stereotypy repetitively and/or displaying different forms of stereotypy. The forms of stereotypy recorded (Cronin and Wiepkema, 1984; Broom and

**FIGURE 1:** Frequency of stereotypy display in control (concrete stalls) and experimental groups of gilts (matted stalls) during the different 28-day production cycles (n = 14 gilts per day and group).
Fraser, 2007) and other behaviours observed including mat manipulation and postural behaviours (standing, sitting and lying), which were assessed by the same method and at the same time as stereotypies, are listed in Table 1. Throughout the study period, display of all behaviours was assessed on a relative number of 224 gilts per group in four production cycles x four days observed per cycle x 14 gilts per day and group (absolute number).

On the days of observation, air temperature in the service unit was measured by a portable digital Testo device (Testo Inc., DE).

Statistical analysis
Statistical data processing and analysis was performed by the licensed Statistica 6.1 software (StatSoft Inc., 1983–2003). Distribution of the number of stereotypy display variable was tested by use of distribution fitting. The variable was found to follow Poisson distribution. The Generalized Linear/Nonlinear model was employed on statistical processing of this (dependent) variable, and logarithm function (log) on model linearization. The Generalized Linear/Nonlinear model was used on testing difference between the control and experimental groups; differences among particular days in the same season (production cycle); and differences among the same days in different seasons according to the number of stereotypies displayed. Statistical difference between the control and experimental groups according to particular stereotypy forms was tested by χ²-test. Correlation of stereotypy display with particular gilt postures and mat manipula-
TABLE 2: Correlation of service unit air temperature with the frequencies of stereotypy display, gilt postures and mat manipulation in control (concrete stalls) and experimental groups (matted stalls)

<table>
<thead>
<tr>
<th>Control</th>
<th>Experimental</th>
<th>Stereotypy display (n)</th>
<th>Standing (n)</th>
<th>Sitting (n)</th>
<th>Lying (n)</th>
<th>Mat manipulation** (n)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air temperature (°C)</td>
<td>-0.273*</td>
<td>0.044</td>
<td>0.576*</td>
<td>-0.217*</td>
<td>0.498*</td>
<td>-0.193*</td>
</tr>
</tbody>
</table>

TABLE 3: Correlation of the frequency of stereotypy display with the frequencies of gilt postures and mat manipulation in control (concrete stalls) and experimental groups (matted stalls)

<table>
<thead>
<tr>
<th>Control</th>
<th>Experimental</th>
<th>Stereotypy display (n)</th>
<th>Standing (n)</th>
<th>Sitting (n)</th>
<th>Lying (n)</th>
<th>Mat manipulation** (n)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stereotypy display (n)</td>
<td>0.163*</td>
<td>-0.054</td>
<td>0.107</td>
<td>0.030</td>
<td>0.047</td>
<td>0.110</td>
</tr>
</tbody>
</table>

TABLE 4: Correlation of the frequency of mat manipulation with the frequency of particular stereotypy display in experimental group of gilts (matted stalls)

<table>
<thead>
<tr>
<th>Mat manipulation (n)</th>
<th>Vacuum chewing (n)</th>
<th>Tongue rolling (n)</th>
<th>Bar biting (n)</th>
<th>Bar licking (n)</th>
<th>Floor licking (n)</th>
<th>Teeth grinding (n)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.022</td>
<td>0.036</td>
<td>0.075</td>
<td>0.029</td>
<td>0.080</td>
<td>0.089</td>
</tr>
</tbody>
</table>

The service unit air temperature during the study period is shown in Figure 4. Significant negative correlation was found between air temperature and frequency of stereotypy display in control group (P <0.05). This finding could have been associated with gilt postures. A decreasing service unit air temperature was associated with a significantly higher rate of assuming standing posture in control gilts (P <0.05) (Tab. 2); in addition, prolonged periods of standing posture were associated with a significantly higher rate of displaying stereotypies (Tab. 3), as confirmed by Sekiguchi and Koketsu (2004).

During cold period, experimental gilts were lying down significantly more frequently (P <0.05) (Tab. 2), as previously reported (Tuyttens et al., 2008; Elmore et al., 2010). However, there was no significant correlation between the frequency of stereotypy display and lying or other postures observed, or between air temperature and stereotypy display (P >0.05 all) in experimental gilts (Tab. 2 and 3).

Rubber mats served to gilts as a stimulus and outlet for exploring, which manifested as licking (Fig. 3) and other, non-stereotypy forms of oral-nasal-facial behaviour, mat manipulation, especially at higher air temperature (P <0.05), when experimental gilts assumed standing posture significantly more frequently (P <0.05) (Tab. 2). Nevertheless, as in case of postures, in the experimental group of gilts there was no significant correlation between the frequency of stereotypy display in total or its particular forms and the frequency of mat manipulation (P >0.05 all) (Tab. 3 and 4).

In conclusion, as there was no significant effect of the factors observed, i.e. body postures and mat manipulation, on the lower rate of displaying stereotypies in experimental gilts, other factors may have been involved, which were not assessed in the present study.

Results and Discussion

Control gilts displayed stereotypies more frequently at the end as compared with the beginning of each production cycle, which is consistent with the results reported by von Borell et al. (1997). A higher rate of stereotypy display was also observed in the experimental group of gilts at the end of each production cycle, with the exception of winter cycle (Fig. 1). However, a statistically significant difference (P <0.05) in displaying stereotypies according to days of the same season (summer and autumn) was only recorded in the control group. There was no statistically significant difference (P >0.05) according to the same days of different seasons in either control or experimental group of gilts.

Between-group comparison according to stereotypy display revealed it to be more common in control gilts during autumn and winter cycle and at the end of summer cycle (Fig. 1). In comparison with experimental group, control gilts displayed stereotypies significantly more frequently (P <0.05) throughout the study period. The rate of stereotypy display in the control and experimental groups of gilts during the study period is illustrated in Figure 2.

Considering display of particular stereotypy forms during the study period, control gilts showed a higher rate of stereotypy display for all forms except for floor licking. Significant between-group differences (P <0.05 all) were found in the frequency of vacuum chewing, bar biting and teeth grinding (Fig. 3).

Conflict of interest

The authors declare no conflicts of interest.

References


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