Short communication

A note on differences in nursing behaviour on pig farms employing individual and group housing of lactating sows

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Abstract

The sow nursing behaviour may be affected by housing environment. So far, studies have focused on within-farm experimental comparisons, but data comparing nursing behaviour in a sample of commercial farms using different housing systems are lacking. This study had the following goals: (I) To compare sow nursing behaviour in a sample of farms with group housing (GH) and individual housing (IH) systems for lactating sows with piglets. (II) To quantify the variability in nursing behaviour attributable to between-farm differences. (III) To document the decline in maternal nursing investment in GH and IH during the last 2 weeks before weaning. The observations were carried out in five GH (6–11 sows kept in a large pen) and in five IH (each sow kept in a small pen) commercial farms. Nursing behaviour of four focal sows per farm was recorded for 6 h in two lactation periods (fourth week, 1 day before weaning; weaning = 5.5 weeks on an average). There was no significant difference between GH and IH farms in total number of nursings, in number of nutritive nursings or in proportion of nursings initiated by the sows. However on GH farms sows terminated higher proportion of nursings \((p = 0.05)\) and allowed piglets’ post-ejection massage for shorter time \((p = 0.02)\). Nursing synchronization was higher among sows on GH than on IH farms.

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The proportion of variability attributable to the between-farm differences ranged between 6 and 30% for the individual nursing behaviour variables. The effect of lactation period was not significant for any of the variables suggesting that maternal investment was not declining between weeks 4 and 6 in either environment.

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1. Introduction

Lactating sows are mostly kept in individual pens equipped with metal farrowing crates that restrict their movement. With increasing efforts to improve welfare of farm animals, feasible alternatives to this housing system have been introduced. Individual straw-bedded pen without the farrowing crate enables the sow to move much more freely. In Sweden increasing number of pigs is being kept in “multi-suckling” or “group housing” systems (Algers and Bergstrom, 1991; Halverson et al., 1997) where groups of lactating sows and their litters are kept together, resembling the stable social unit of wild forms of Sus scrofa (Graves, 1984). The different degree of movement freedom and social contact in the above-mentioned housing systems may alter the nursing–suckling interactions between sows and piglets.

In many mammalian species (for example: Alces alces—Stringham, 1974; Mus domesticus—König, 1994), both the nursing frequency and the access to the udder decrease as lactation progresses (Trivers, 1974). These processes have been also documented in domestic pigs. In the first 2 weeks of lactation pig mothers actively invest into their young (Jensen, 1988; Bøe, 1991). During the third to fourth week of lactation, sows stop to initiate the nurings (Jensen, 1988; Bøe, 1991) and the nursing frequency tends to decrease (Puppe and Tuchscherer, 2000). Moreover, sows increasingly limit the quantity of post-ejection udder massage through earlier termination of the nurings, which may contribute to the gradual reduction of milk production (Algers and Jensen, 1991; Špinka and Algers, 1995). This gradual reduction of maternal investment may proceed differently in the individual and group housing systems for lactating sows. In group housing systems, which provide more space and more complex social environment, it may be easier for the sows to fend off the behavioural attempts by the piglets to increase the maternal investment.

Nurings that do not contain milk ejection are a natural part of the sow’s nursing behaviour (Castreñ et al., 1989; Illmann and Madlafousek, 1995). If the given nursing follows after a shorter than usual interval since the last milk ejection or if it is initiated by piglets rather than by sows the probability of milk let down is reduced (Whatson and Bertram, 1980; Castreñ et al., 1989). The probability of milk ejection failure is thus related to nursing frequency and nursing initiation and may be affected by the richer social contacts occurring in the group housing system.

In lactating sows housed in different environments the nurings of individual sows tend to be highly synchronized in time, probably through acoustic communication (Newberry and Wood-Gush, 1985; Wechsler and Brodmann, 1996; Maletínská and Špinka, 2001;
In group housing nursing synchronization may help to reduce cross-suckling (suckling of alien piglets at dams that are not their mothers) (Wattanakul et al., 1998; Maletínska and Špinka, 2001; Illmann et al., 2005) and therefore, higher nursing synchronization may be expected on the farms using the group housing system.

The three aims of this study were: (i) to assess whether sow nursing behaviour differs between farms using individual and group housing systems for lactating sows; (ii) to assess the proportion of variability in nursing behaviour that can be attributed to the between-farm differences; (iii) to quantify the decline in maternal nursing investment in the two housing systems during the last 2 weeks before weaning.

2. Methods

2.1. Farms

The observations were carried out in 2002 on 10 commercial farms in south-western Sweden. Five farms with a group housing (GH) system (Halverson et al., 1997) and five farms where the sows were individually loose housed in farrowing pens (IH) were selected for the study.

In GH farms (herd size = 60–100 sows), sows of the same stage of pregnancy were housed in stable groups of 6–12 animals in straw-bedded pens. One week before parturition, sows were placed into individual farrowing straw-bedded pens (6 m² per sow on an average). Several sows (one stable group) with their piglets were moved into a large group pen when piglets were 11–20 days of age and where they remained until weaning. Each of these group pens occupied a whole room with the average space allowance of 8.6 m² per sow. In one of the GH farms the group of sows was placed in such room already within the last week before parturition and each sow gave birth in a nest built inside wooden removable pen. When their piglets reached 7–10 days, then the wooden walls of pens were removed. In all GH farms 4/5 of the room area comprised of the lying area covered with deep straw bedding. The remaining elevated part of the room served as drinking and eating area. The sows were fed a standard diet for lactating sows with the ad-lib regime up to the weaning. Piglets had free access to sow feeders and were also provided with a standard piglet diet from piglets’ feeders.

All the IH farms were a part of the “Sow pool” systems. This system is based on contractual renting of groups of pregnant sows. Each farmer receives a group of pregnant sows of the same stage of pregnancy 3 weeks before expected parturition date. The group of sows is housed in one large straw-bedded room for 2 weeks. One week before parturition, the sows are placed into individual farrowing straw-bedded pens (6.7 m² per sow on an average) located in a farrowing room for 20–60 sows. The sows were fed a standard diet for lactating sows, two times per day; 8 kg/day per sow on an average. The piglets were two times per day provided with a standard piglet diet served from piglets’ feeders.
2.2. Animals and observations

Four multiparous Landrace sows (parity 2–4.5) of similar litter size (10–13 piglets) and age were randomly chosen on each farm when their piglets were between 11 and 20 days of age. In GH farms they were selected out of one stable group. In IH farms sows, which were housed in four pens next to each other were selected. The focal sows in GH farms were differently colour marked on their backs prior to observations.

The direct 6 h behavioural observations (between 10 a.m. and 4 p.m.) of four focal sows’ nursing behaviour were accomplished on each farm by two observers when piglets were around 4 weeks of age and also 1 day prior to weaning (weaning day = 33–50 days in

<table>
<thead>
<tr>
<th>Description</th>
<th>Definition</th>
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<tbody>
<tr>
<td><strong>Behavioural patterns</strong></td>
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<tr>
<td>Start of the nursing (time)</td>
<td>At least two piglets are massaging teats; the sow exposes the udder and starts characteristic nursing grunting</td>
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<tr>
<td>End of the nursing (time)</td>
<td>When &lt;3 piglets are active at the udder</td>
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<tr>
<td>Start of the milk ejection (time)</td>
<td>When all piglets synchronously start performing intense rhythmical sucking movements. The piglets “freeze” at the udder for 10–20 s</td>
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<tr>
<td>End of milk ejection (time)</td>
<td>Piglets start switching between teats and/or massaging teats of sow after milk ejection</td>
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<tr>
<td>Nutritive nursing</td>
<td>Nursing that includes milk ejection</td>
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<td>Non-nutritive nursing</td>
<td>Nursing that does not include milk ejection</td>
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<td>Nursing initiated by the sow</td>
<td>The sow assumes the lateral nursing position and starts grunting before any piglet is massaging her udder</td>
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<td>Nursing terminated by the sow</td>
<td>When the sow stands up or roles over to her belly while there are still ≥3 piglet massaging her udder</td>
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<tr>
<td>Bout of synchronized nursings</td>
<td>A row of overlapping nursings by the focal sows. Two nursings were considered overlapping when the interval between the start of the nursing of one sow and her end of milk ejection overlapped with the same interval of another sow</td>
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<tr>
<td><strong>Nursing behaviour variables</strong></td>
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<tr>
<td>Total number of nursings</td>
<td>Number of all nursings observed during the 6-h observation period</td>
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<tr>
<td>Number of nutritive nursings</td>
<td>Number of nutritive nursings observed during the 6-h observation period</td>
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<td>Post-ejection massage duration</td>
<td>Average time period between end of the milk ejection and end of the nursing</td>
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<tr>
<td>Proportion of nursings initiated by the sow</td>
<td>Number of nursings initiated by the sow divided by the total number of nursings</td>
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<tr>
<td>Proportion of nursings terminated by the sow</td>
<td>Number of nursings terminated by the sow divided by the total number of nursings</td>
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<tr>
<td>Average rate of nursing synchronization</td>
<td>Mean number of focal sows (between 0 and 3) that nursed in the same synchronized bout with the sow in question was divided by 3. This mean number was averaged over the four focal sows on farm</td>
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IH farms, 33–42 days in GH farms). Behaviours of four focal sows per farm as defined in the first part of Table 1 were recorded.

2.3. Statistical analysis

The six nursing behaviour variables are defined in the second part of Table 1. The first five variables (all except nursing synchrony) were calculated for each of the 40 focal sows. These variables were submitted to a SAS MIXED Procedure (SAS Institute, 2002) with the fixed factors of farm type (HOUSING – GH versus IH), lactating period (DAY – week 4 versus weaning-1) and the DAY × HOUSING interaction. The random factors were FARM and SOW nested within FARM. The proportion of variability attributable to between-farm differences was extracted from the estimates of the covariance parameters. Since behavioural synchronization cannot be measured independently for individual animals (Schank, 1997), the average synchronization rate was calculated across the four sows per farm, and the model for this variable did not include the random SOW factor. In order to improve the normality of residuals, the percentile variables were arcsine transformed and the other three variables log transformed before running the model.

3. Results

The MIXED model revealed that the interaction DAY × HOUSING was not significant for any of the variables. Therefore, only the main effects of HOUSING (GH versus IH) and DAY (week 4, weaning-1) are reported here. The HOUSING system had no significant influence on the total number of nursings ($F_{(1,8)} = 0.12, p = 0.74$; Fig. 1), on the number of nutritive nursings ($F_{(1,8)} = 0.00, p = 0.99$; Fig. 1), or on the proportion of sow-initiated nursings ($F_{(1,8)} = 0.08, p = 0.78$; Fig. 2). The proportion of sow-terminated nursings was higher in GH farms ($F_{(1,8)} = 5.58, p = 0.05$; Fig. 2), and the post-ejection udder massage

![Figure 1](chart.png)

Fig. 1. Number of total and nutritive nursings recorded per sow during the 6 h of observations. Means of two lactating periods ± S.E. based on averages, $n = 5$ GH and 5 IH farms. ns, Not significant.
was shorter in GH farms ($F_{(1,8)} = 8.08, p = 0.02$; Fig. 2). Nursing was much more synchronized in GH farms ($F_{(1,8)} = 13.56, p = 0.006$; Fig. 3).

The proportion of variability due to between-farm differences was as follows: for the total number of nursings 0.185, for the number of nutritive nursings 0.064, for the proportion of sow-initiated nursings 0.140, for the proportion of sow-terminated nursings 0.171 and for the post-ejection udder massage length 0.297.

There was very little change in the nursing behaviour during the last 2 weeks before weaning, indicating no decline in maternal investment during this period. The DAY effect was not significant for the total number of nursings ($F_{(1,8)} = 0.27, p = 0.62$), the number of nutritive nursings ($F_{(1,8)} = 0.01, p = 0.93$), the proportion of nursings initiated or terminated by the sow ($F_{(1,8)} = 2.85, p = 0.13$ and $F_{(1,8)} = 0.82, p = 0.39$), the duration of post-ejection massage ($F_{(1,8)} = 2.03, p = 0.19$) and the mean synchronization rate ($F_{(1,8)} = 0.05, p = 0.83$).
4. Discussion

To our knowledge, this is the first study investigating pig nursing behaviour in a sample of commercial farms with two different housing systems. Previous studies (e.g. Bryant et al., 1983; Arey and Sancha, 1996; Hötzel et al., 2004) did compare nursing behaviour in different housing systems, but all of them made the comparison within one (often experimental) farm. This approach may bring more clear-cut results, but misses the practically important “random” variation between farms actually operating the two systems. This variation arises from idiosyncratic properties of individual farms such as spatial disposition, daily regime, the farmer’s way of managing the husbandry, etc. It is important to know whether the differences found in well-controlled studies also hold in the practical conditions of farms. By comparing five farms with individual and five farms with group housing system for lactating sows, this study attempted to make a step into this direction. We documented that in the two farm housing systems there were some similarities and some differences in sow nursing behaviour. The frequency of total and nutritive nursings was not different in both systems. The GH sows terminated nursings more often than IH sows, GH piglets massaged their mothers’ teats for shorter time, and nursing synchronization was much higher in GH than in IH farms.

With regard to nursing frequency our results are in agreement with Bryant et al. (1983), who did not find any difference in number of nutritive nursings per 24 h between GH and IH. However, most other studies reported lower nursing frequencies in systems where sows had more freedom of movement (Arey and Sancha (1996)—GH versus IH; Hötzel et al. (2004)—outdoor system versus indoor system; Newberry and Wood-Gush (1985)—semi-natural conditions). The lack of difference in our study may have been caused by the fact that the contrast between GH and IH housing was lesser than in previous studies. Sows on IH farms were housed in pens and it is possible that they still had a stronger control over the nursing frequency than sows housed in farrowing crates.

We suppose that more variable environmental (large pen) and social stimuli in GH pens increased the tendency of sows to terminate nursings. High termination rate of the nursings by the GH sows was also reported by Bøe (1991), Dybkjaer et al. (2003) and Damm et al. (2003), although a direct comparison by Arey and Sancha (1996) did not bring a significant difference.

There was no difference in the proportion of nursings initiated by sows between GH and IH sows what was also reported by Wattanakul et al. (1998) and Arey and Sancha (1996). At the age when we were observing the nursings, the initiative is mostly on piglets’ side (Damm et al., 2003; Valros et al., 2002). With less than 10% of nursings initiated by sows in our study, there was little space for any GH–IH differences.

We found higher nursing synchronization on GH farms, and this is in agreement with most previous studies (e.g. Bryant et al., 1983; Newberry and Wood-Gush, 1985; Wattanakul et al., 1997), but see Johnson et al. (2001). Several factors may contribute to the higher synchronization in GH sows: (1) the shorter distance between two nursing sows (Newberry and Wood-Gush, 1985; Špinka et al., 2004). (2) More direct acoustic (Newberry and Wood-Gush, 1985), visual and olfactory contact with each other. (3) Higher motivation of sows to synchronize because of the danger of allosuckling (Maletínská and Špinka, 2001; Illmann et al., 2005).
The between-farm variability accounted for about 17% of the nursing behaviour variation (range 6–30% for the five variables) in our study. This figure is probably an underestimation, since farms in our study were more similar to each other (e.g. through the “sow-pool” system in IH farms or through the tradition of sharing experience among the GH farms) than would be IH and GH farms in Europe at large. The between-farm variability should be taken into account where experimental results are being extrapolated to practical farming conditions.

We found little change in nursing behaviour during the last 2 weeks before weaning indicating no decline in maternal nursing investment during this period. Especially surprising is the lack of decline in nursing frequency because this finding contrasts with previous studies documenting a decrease in nursing frequency (Rantzer et al., 1995; Arey and Sancha, 1996; Pitts et al., 2002). Other studies, however, found that this decrease levels off at some time between the third and fifth week of lactation (Whatson and Bertram, 1980; Bryant et al., 1983; Jensen, 1988; Valros et al., 2002). It is therefore possible that our observation period captured a plateau between the initial nursing frequency reduction in early lactation and the final decline to zero.

Nursing termination by the sow shows a clear upsurge during the first weeks of lactation (Whatson and Bertram, 1980; Jensen et al., 1991) and nursing initiation by the sow shows a similarly steep decline (Jensen, 1988; Boe, 1991). No further changes in these two aspects of nursing occur later in lactation, which is consistent with our results.

Our data together with a part of the published studies thus indicate that between weeks 4 and 6 of lactation, maternal nursing investment does not decline substantially either in individual pens or in the group housing. Indirectly this implicates that the relatively late weaning at 5–6 weeks, as practised on the Swedish farms, will not result in major growth check in the piglets or an overstretched demand on the sow.

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